HERITAGE REMEDIATION/EN ... NEERING, INC.



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July 2, 1992

Mr. A. William Nosil Engineering Manager HEXCEL Company 11555 Dublin Blvd. Dublin, CA 94568

DRAFT

RE: Bedrock Aquifer

Characterization Report Fine Organics Project Lodi, New Jersey

HR/E Project No. 61064

Dear Mr. Nosil:

Attached is the above referenced Bedrock Aquifer Characterization Report. This report details information derived from the packer and aquifer pumping test of the Fine Organics production well April 22-24, 1992 and according to Task 1, Work Order 41.9. As you will note, a copy of this draft report has been provided to Killam Associates.

Except for my review and some finishing touches, this work was performed prior to your letter of June 11, 1992. Should you have any questions or concerns, please do not hesitate to call.

Respectfully,

Heritage Remediation/Engineering, Inc.

Robert M. Baumgartner

sout M. Baunza

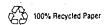
Hydrogeologist

Robert R. Beckwith, CPG

Senior Hydrogeologist

Attachment

cc: William F. Hoehlein, Killam Associates.





DRAFT BEDROCK AQUIFER CHARACTERIZATION REPORT FOR FORMER HEXCEL INDUSTRIAL CHEMICALS FACILITY

Lodi Borough, Bergen County Lodi, New Jersey

ECRA Case #86009

Submitted to:

HEXCEL Company 11555 Dublin Boulevard Dublin, California 94568

Prepared by:

Heritage Remediation/Engineering, Inc. 5656 Opportunity Drive Toledo, Ohio 43612

July 2, 1992

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1.0 INTRODUCTION

The former Hexcel Industrial Chemicals Group, Lodi Facility, presently known as Fine Organics Corporation (FO) is located in Lodi, New Jersey. Considerable work has been completed on site since 1985 under the Environmental Cleanup Responsibility Act (ECRA). This report covers only that portion of the project related to the evaluation of the bedrock aquifer.

Four packer tests and an aquifer pumping test were performed on the FO production well (PW) to characterize the relationships, both chemical and hydrologic, between the bedrock aquifer and the overlying overburden aquifers.

1.1 Site Description

The site is located along the east side of the Saddle River in Lodi, New Jersey. Ground water for industrial use is obtained from a 12 inch, open borehole well, PW, set in the silt and sandstone bedrock. The well, cased to bedrock at about 38 feet and open borehole to total depth at 240 feet, is located in the northwest quarter of the property. The well location is shown on Figures 17, 18 and 19.

Several monitoring well clusters are present across the site (Figures 17, 18 and 19). The monitoring well clusters are set to monitor two separate hydraulic units designated as the upper and lower overburden aquifers. In general the hydraulic units are described as silty sands and gravels separated by a silty clay unit at 7 to 16 feet below grade. Lower overburden aquifer monitoring wells are double cased through the upper overburden aquifer into the silty clay unit and screened in the lower overburden and are generally designated using odd numbers. The upper overburden aquifer monitoring wells are screened above the silty clay unit. The monitoring wells were utilized for ground-water level measurements during aquifer evaluation.

1.2 Project Description

Four discrete zone packer tests and a 24 hour aquifer pumping test were performed on the FO PW to characterize the relationships, both chemical and hydrologic, between the bedrock aquifer and the overlying overburden aquifers.

1.2.1 Packer Testing

The discrete zone packer tests were initiated on April 22, 1992 and completed the following day. Each test consisted of sealing the well bore, both above and below discrete zones within the production well, using inflatable well packers and pumping ground water from between the packers. Water levels in wells immediately surrounding the production well were monitored for change. Samples for chemical analyses were retrieved from the pump discharge at the wellhead following one hour of pumping from each zone tested.

1.2.2 Production Well Pump Testing

The aquifer pumping test was initiated on April 23, 1992 using the FO PW pump and piping. The average pumping rate during the test was 140 gallons per minute. The water levels in a number of monitoring wells (both upper and lower overburden) located throughout the site were recorded during the aquifer pumping test.

2.0 GROUND-WATER HYDRAULICS OF THE LOWER OVERBURDEN AQUIFER AND BEDROCK AQUIFER

Aquifer tests performed on the FO PW have provided data which show the lower overburden aquifer to be hydraulically connected to the bedrock aquifer.

2.1 Production Well Packer Testing

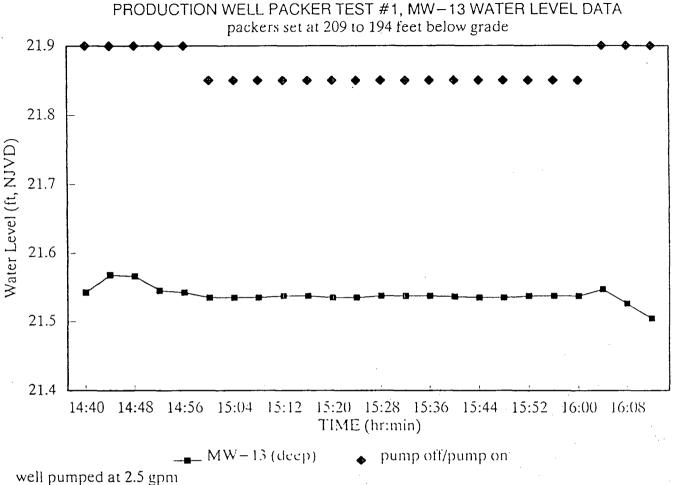
A packer test was performed to obtain water samples from four distinct depths in the facility's 12-inch diameter PW. According to geophysical logs of the well, productive zones occur at 60-68 feet, 122-130 feet and 198-208 feet. HR/E utilized inflatable packers to isolate productive zones within the open bore hole of the well. An additional packer test was performed at the base of the outer steel casing of the well at a depth of 34-44 feet to assess the possibility of conduit flow around the outer casing.

Ten-inch diameter inflatable packers were used to isolate the target zones. The production well pump and associated piping was removed from the well prior to packer emplacement. The packers were set fifteen feet apart on a 1-1/4 inch drop pipe and included a standard submersible pump set between the packers. Discharge from the test was directed to the industrial sewer through FO's discharge sump to provide uninterrupted monitoring of discharge parameters. The packers were lowered to the appropriate depths and inflated using an inert gas (nitrogen). Each target zone was pumped for one hour at approximately 2.5 gallons per minute.

Static water levels and pumping water levels were assessed during the packer test. During the purging/pumping of each zone, changes in water levels were measured in the surrounding lower overburden aquifer wells (PI-1 and MW-15) using a hand held water level meter. The OmniData, Inc. DataPod datalogger was installed in MW-13 to provide nearly continuous water level data during the packer test and the ensuing

pumping test. Figures 1 through 4 provide graphs of the changes in water level in MW-13 during pumping of each zone.

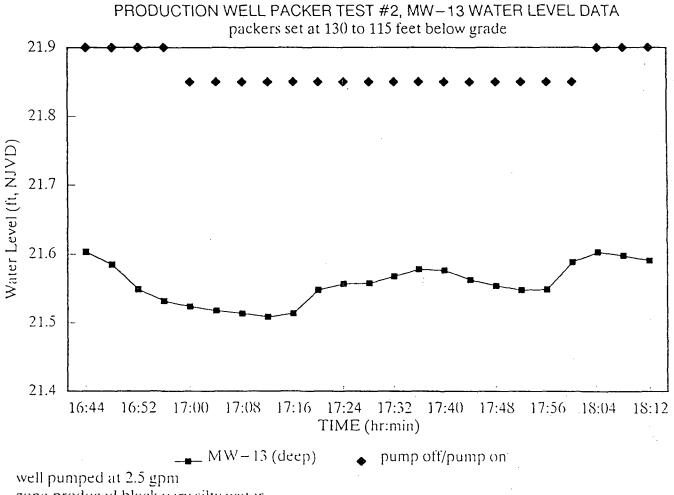
The data show direct response in the water level in MW-13 to pumping during Test #3 and Test #4. Test #3 (55-70 feet) showed the most direct response. Test #4 (25-40 feet) shows less response due to the presence of the solid casing over most of the tested interval. Pumping from zone 1 (Test #1, 194 to 209 feet) and zone 2 (Test #2, 115 to 130 feet) showed little or no direct response respectively. This suggest the possibility of a zone of less permeable material between 70 and 115 feet below grade. Data indicates hydraulic connection between the lower overburden aquifer and the bedrock aquifer.



well pumped at 2.5 gpm zone produced clear silt free water

Figure 1

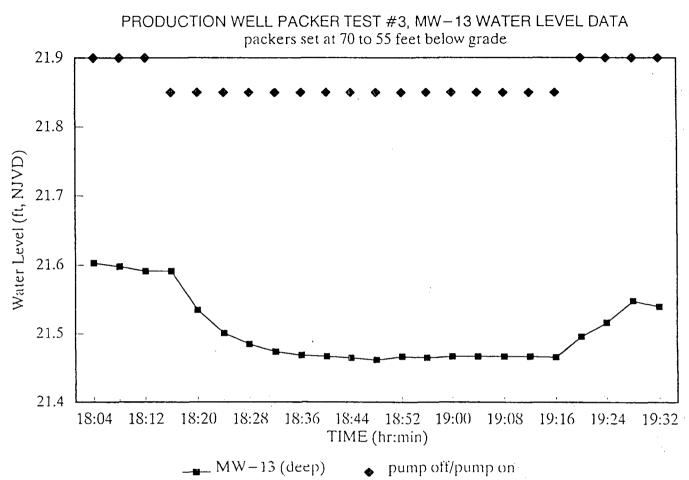
The data represented in this graph shows that minor water level fluctuations in MW-13 stop once pumping began, however, the minor fluctuations both before and after pumping may be the result of positioning the packer set. The data show little or no direct response of water levels in MW-13 to pumping from this zone of PW.



zone produced black very silty water

Figure 2

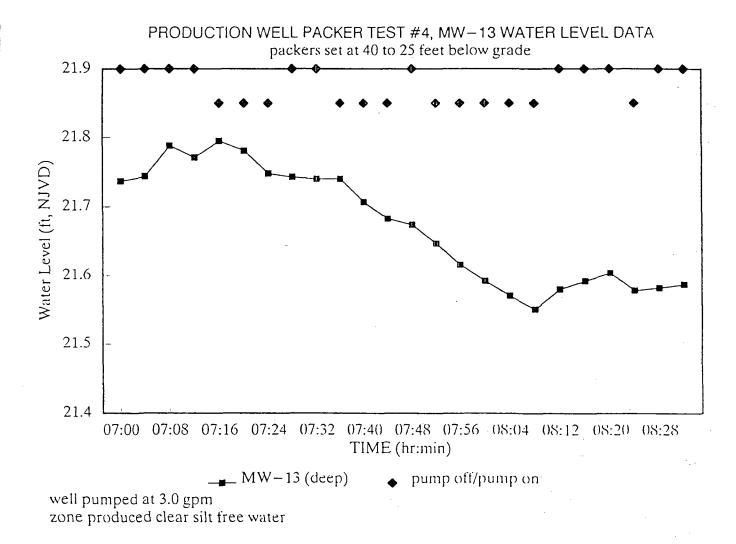
Initially, the data represented in this graph appears to be showing drawdown in the water level in MW-13, however, the drawdown begins prior to pumping and the water level in MW-13 rises and falls during the period of pumping. This data shows no direct response in the water level in MW-13 to pumping from this zone of PW.



well pumped at 2.5 gpm zone produced clear slightly silty water

Figure 3

The data represented in this graph shows direct and immediate response in the water levels in MW-13 to pumping from this zone of PW.



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Figure 4

The data represented in this graph show direct and immediate response in the water levels in MW-13 to pumping from this zone of PW. The presence of the solid casing over the majority of this tested interval provided little area for infiltration allowing the tested interval to be pumped dry twice during the test.

2.2 Trend Measurements in the Lower Overburden Aquifer

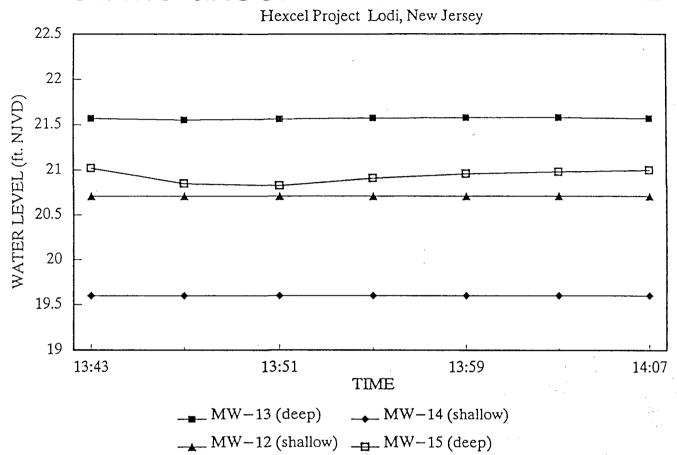
Prior to initiation of the aquifer pumping test, water level trends were monitored in MW-12 and MW-14 (upper overburden aquifer monitoring wells) and MW-13 and MW-15 (lower overburden aquifer monitoring wells). The trend analysis (Figure 5) of the two shallow wells, MW-12 and MW-14, showed no fluctuation in water level. The two deep wells, MW-13 and MW-15, showed slight fluctuation with a water level decrease during the initial stages of measurement of approximately 0.02 feet and 0.2 feet respectively.

2.3 Bedrock Aquifer Pumping Test

A twenty four hour pumping test of the bedrock aquifer was conducted on April 23 and 24, 1992. The pumping test was performed on PW using the existing submersible pump. To minimize the recirculation of the ground water back to the well four available discharge valves were opened inside the facility. An In-Situ HERMIT 1000B data logger equipped with two 10 psig pressure transducers were utilized to collect data from MW-14 and MW-15. A Datapod II datalogger equipped with two 10 psig pressure transducers was used to collect data from MW-12 and MW-13. These monitor well sets are closest to the PW. Water levels at selected other locations in both the lower overburden aquifer and the upper overburden aquifer were monitored.

Maximum ground-water drawdown occurred 23 hours into the test. The maximum drawdown data are presented in Table 1. The PW was producing a constant 140 gallons per minute throughout the test except for a slight decrease at about 18 hours into the test (09:45 AM on April 24) when the rate dropped to 130 GPM for approximately 1 hour. This was caused when a discharge valve inside the facility was inadvertently turned off. Once discovered, the problem was immediately rectified.

STATIC GROUND-WATER LEVEL TREND



Water levels recorded prior to initiation of pump test

Figure 5

The graph shows data collected on April 23, 1992 from monitoring wells MW-13 and MW-15, set in the lower overburden aquifer, and monitoring wells MW-12 and MW-14, set in the upper overburden aquifer. The data shows minor fluctuations in the water levels in the lower overburden aquifer and no changes in the water levels in the upper overburden aquifer.

TABLE 1 DISTANCE-DRAWDOWN DATA

(after 1380 minutes)

Well No.	Distance from PW (ft)	Drawdown (ft)
PW	0.0	31.2
MW-1	363	0.57
MW-3	319	1.31
MW-5	255	1.74
MW-7	184	1.54
MW-9	164	1.37
MW-11	326	0.92
MW-13	71	3.22
MW-15	79	1.55
* MW-17	370	0.56
MW-19	236	1.97
PI	140	1.48
* MW-20	459	0.20

PW - FO production well

PI - Pilot well

The water levels in the surrounding wells showed direct response to pumping from the PW. Graphic representation of the water level data from these wells is presented in Figures 6 through 11. Significant drawdown was observed in two upper overburden aquifer wells MW-17 and MW-20 (Figure 9). MW-17 and MW-20 are located 370 and 460 feet southeast of the PW respectively. The silty-clay confining layer thins or is absent in this area as indicated from boring logs. The drawdown observed indicates hydraulic connection between the upper and lower overburden aquifers in this area.

This was the only area where this occurrence was observed.

^{*} The upper overburden aquifer wells that showed a reaction to the pumping of the FO production well.

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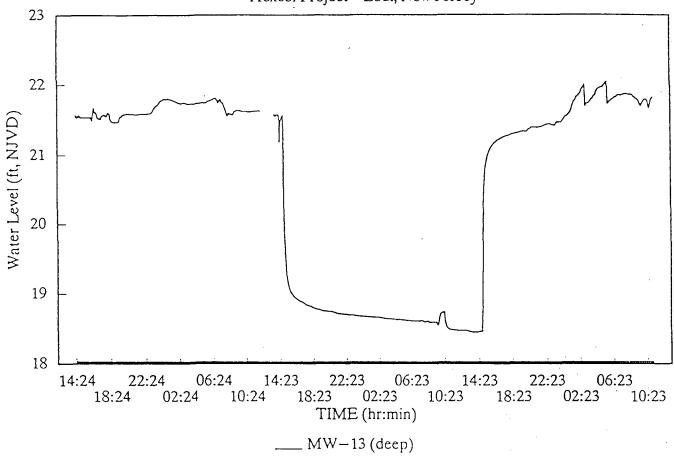
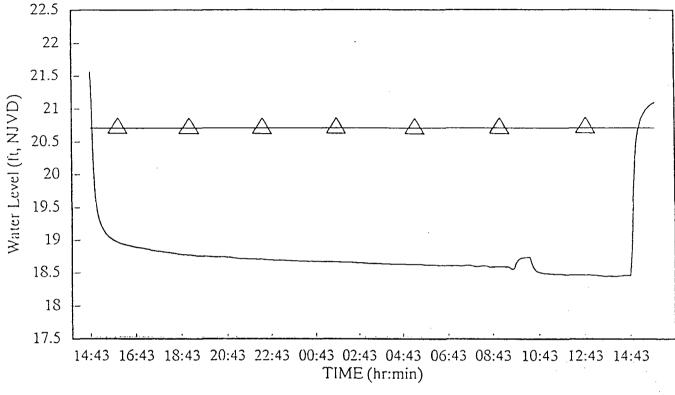


Figure 6

Data shows the reaction of the water level in MW-13 to pumping from the FO production well. Initial variations are caused by packer testing and are represented in prior figures. Data shows direct hydraulic connection between the bedrock aquifer in which the production well is set and the lower overburden aquifer in which MW-13 is set. The immediate response noted in MW-13 suggests confined aquifer conditions. This indicates a aquiclude present above the lower overburden aquifer.

7.

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____ MW-13 (deep)

 \triangle MW-12 (shallow)

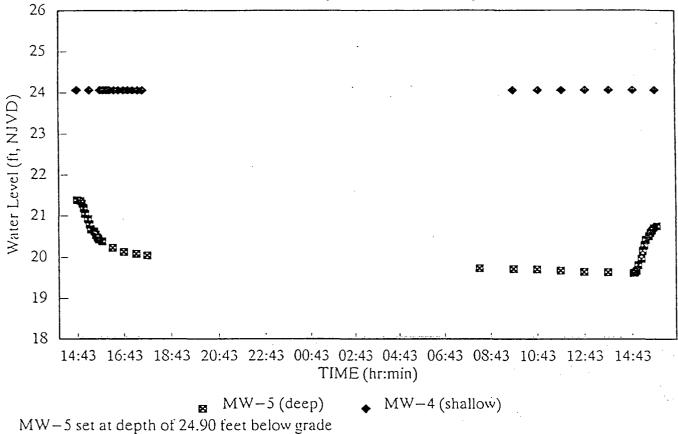
MW-13 set at depth of 29.70 feet below grade

MW-12 is set at depth of 13.60 feet below grade

Figure 7

Data shows the relationship between the water levels in the lower overburden aquifer (MW-13) and the upper overburden aquifer (MW-12). The lack of response in MW-12 confirms the presence of a confining unit between the upper and lower overburden aquifers in this area. This well cluster is set approximately 70 feet from the FO production well at about 90° to the Saddle River.

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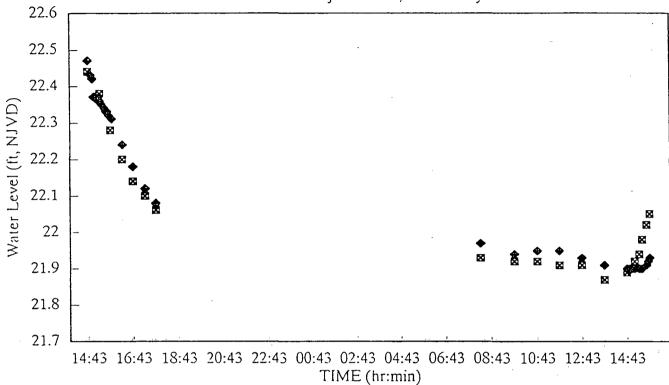


MW-4 is set at depth of 6.50 feet below grade

Figure 8

Data shows the relationship of water levels in the lower overburden aquifer (MW-5) and the upper overburden aquifer (MW-4) to pumping from the FO production well. The lack of response in MW-4 confirms the presence of a confining unit between the upper and lower overburden aquifers in this area. This well cluster is set approximately 255 feet from the FO production well at about 90° to the Saddle River.

Hexcel Project Lodi, New Jersey



MW-1 (deep)

MW-17 (shallow)

MW-1 set at depth of 20.20 feet below grade

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MW-17 is set at depth of 12.00 feet below grade

Figure 9

Data shows the relationship between the lower overburden aquifer (MW-1) and the upper overburden aquifer (MW-17). The nearly identical response in the two wells confirms the lack of a competent confining unit between the two aquifers in this location. This well cluster is set approximately 365 feet from the FO production well at about 90° to the Saddle River.

Hexcel Project Lodi, New Jersey

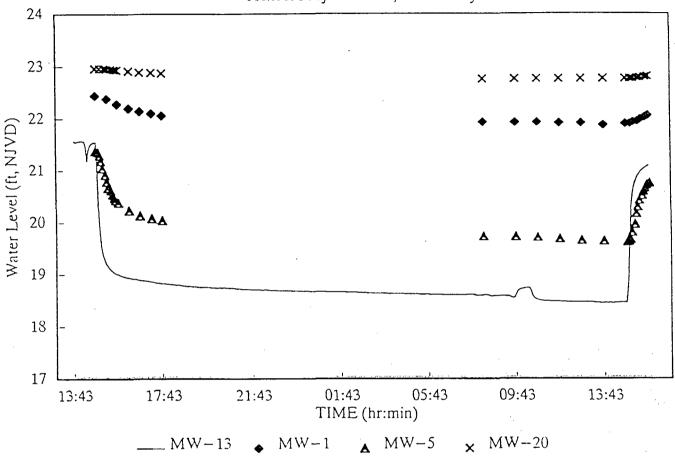


Figure 10

Data shows the relationship of water levels in wells located along a line running roughly perpendicular to the Saddle River. MW-13 is set 70 feet from the FO production well, MW-5 at 255 feet, MW-1 at 365 feet and MW-20 at 460 feet. Note the declining drawdown with distance from the production well.

Hexcel Project Lodi, New Jersey

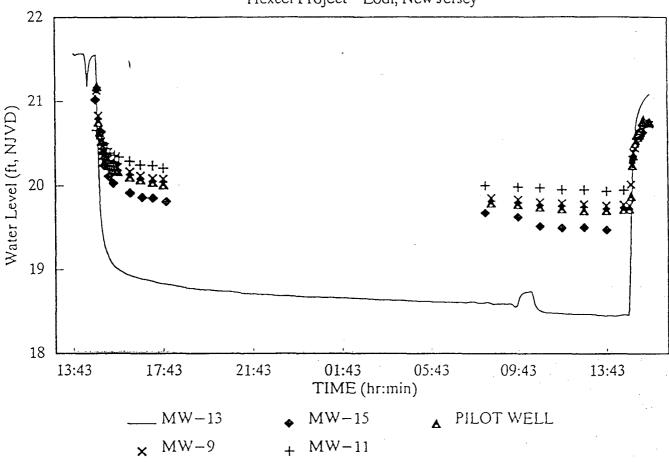


Figure 11

Data shows the relationship of water levels in wells located along a line running parallel to the Saddle River. MW-13 has been included as a reference line for comparison of Figures 10 and 11. MW-15 is set 80 feet from the FO production well, Pilot Well is 140 feet, MW-9 is 165 feet and MW-11 is 325 feet away. Note that the wells still show declining drawdown with distance from the production well, however, the spread is greatly reduced. This may be the result of influence from the Saddle River or some lithologic or structural controlling factor (i.e. bedding plains, fractures or joints).

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2.4 Bedrock Aquifer Hydraulic Properties

The Jacob straight line method (Cooper and Jacob 1946) was initially used to evaluate the aquifer hydraulic parameters. The computer program, "Easy Jacob", July 1991 by Endless Mountain Groundwater, Etters, Pennsylvania, was utilized to generate the Jacob straight line graphs. The resulting straight line graphs show several variations from the theoretical straight line. The resulting transmissivity and storativity values were not considered reliable. Some general information was determined from the graphs.

The graph for data from MW-17 shows a sudden increase in drawdown (slope change) approximately 80 minutes into the pump test indicating a decrease in infiltration rate. This may be the result of a less permeable boundary nearby, or the result of dewatering of the upper overburden aquifer at this location. Straight line graphs of data from most of the remaining monitoring wells show one or more slope changes through the test period. The slope changes indicate progressively less drawdown than expected. This can be caused by the cone of influence intersecting recharge boundaries or fracture zones or leakage from overlying or underlying strata. Pump test data and Jacob straight line graphs are presented in Appendix A.

Drawdown data from selected wells was imported into a graphic analysis program written by Mark Collins of the Illinois State Water Survey (1984). This is a BASIC language aquifer test program based on the Theis type-curve graphical method and a modification of this by Walton (1962) for leaky artesian aquifer curve matching. The data was initially compared to Theis type-curves for non-leaky artesian aquifer conditions. Deviations from these type curves indicated possible leakage so the data was compared to Walton's type curves for leaky artesian aquifers. Figures 12 through 16 provide comparisons of this data from selected wells in graphic format. Table 2 provides a summary of selected transmissivity, storativity and leakage values.

The time-drawdown graphs of several of the wells deviate from theoretical Theis type curves for confined, non-leaky aquifers. In most cases the actual data drops below theoretical curves indicating less drawdown than expected. In general this is caused by increased recharge to the well. Several potential factors could contribute to this. These include; a) the cone of depression intersecting a recharge boundary, b) the effects of leakance through a confining unit, either above or below the aquifer zone tested, c) variations in the hydraulic properties within the tested zone (i.e. change from bedrock to unconsolidated soils, bedding plains, rock fractures, etc.) or d) any combination of a,b and c (most likely scenario). Monitoring wells MW-7 and MW-19 (recovery data) produced the only data sets which closely match theoretical curves (Theis) for confined non-leaky aquifer conditions.

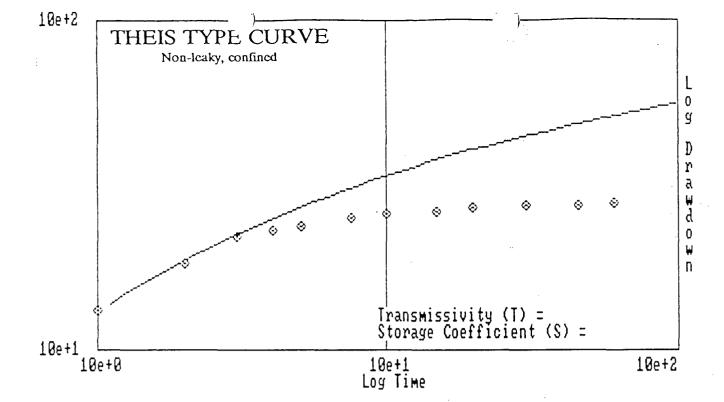
TABLE 2
HYDRAULIC PARAMETERS FROM SELECTED WELLS

Well No.	Transmissivity (gal/day/ft)	Storativity (dimensionless)	Leakage Factor (gal/day/ft ³)
MW-3	2.8 x 10 ⁴	6.1 X 10 ⁻⁴	8.7 x 10 ⁻²
MW-5	6.1 x 10 ³	8.8 X 10 ⁻⁴	1.7 x 10 ⁻¹
MW-9	2.0 x 10 ⁴	9.9 X 10 ⁻⁴	5.3 x 10 ⁻¹
MW-15	5.3 x 10 ⁴	2.4 X 10 ⁻³	1.7 x 10 ⁻¹
GEOMETRIC MEAN	2.1 x 10 ⁴	1.1 X 10 ⁻³	1.9 X 10 ⁻¹

2.5 Aquifer Test Recovery Data

Water level recovery measurements were collected for 1 hour after completion of the 24 hour aquifer pump test. The water level recovery measurements provide a second set of data that was used to verify the results of drawdown data. In all cases, recovery data provided a good match to drawdown data. The lower overburden monitoring wells (and two upper overburden) showed water level recovery related to the end of the pump test.

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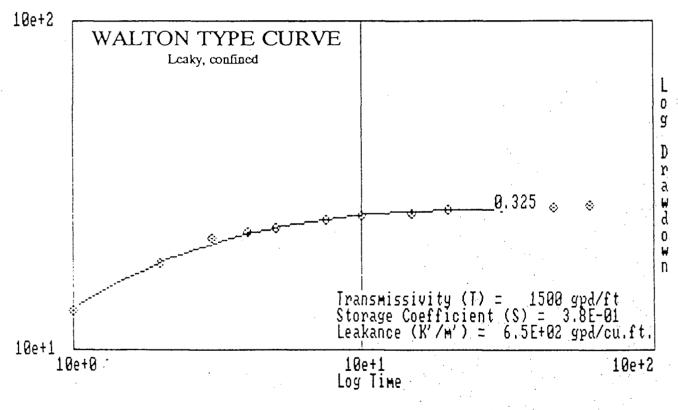
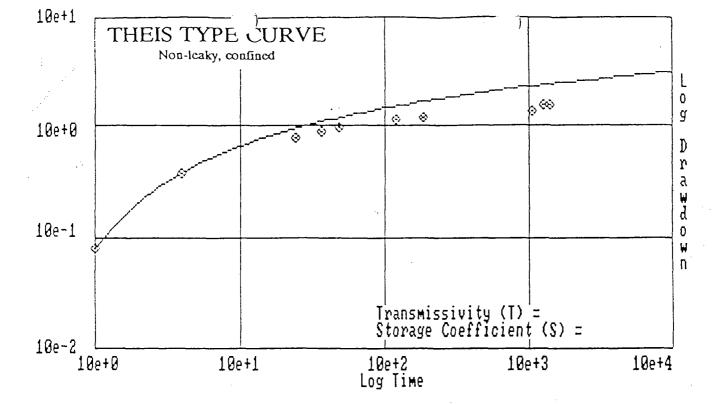


Figure 12

Drawdown data from the Fine Organics production well.

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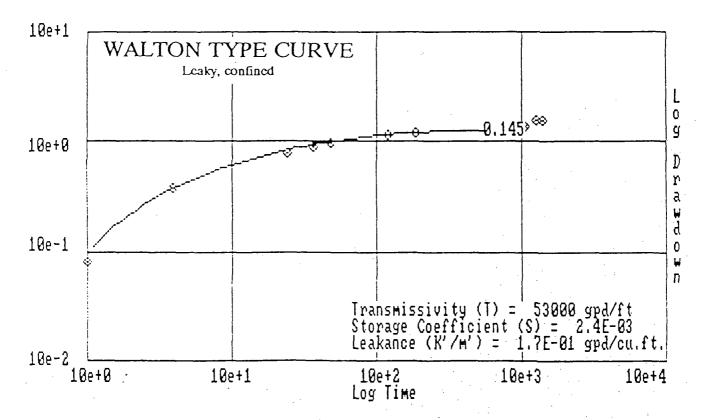
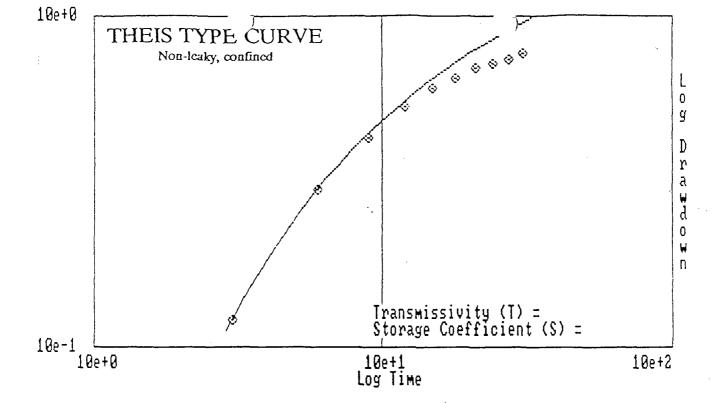


Figure 13

Drawdown data from MW-15.



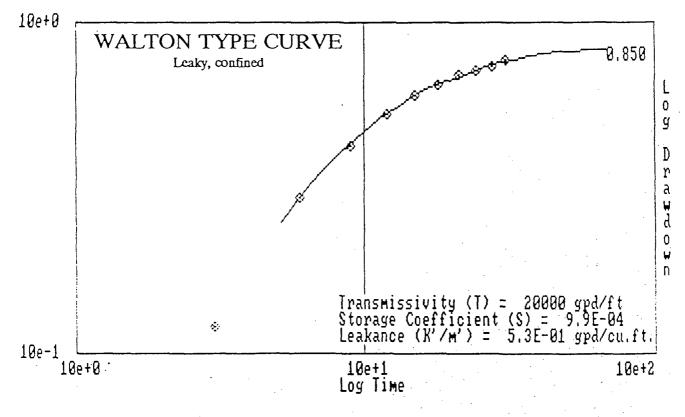
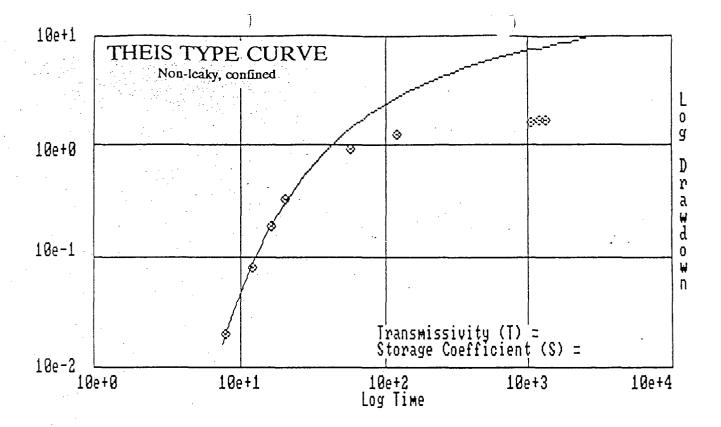


Figure 14

Drawdown data from MW-9.



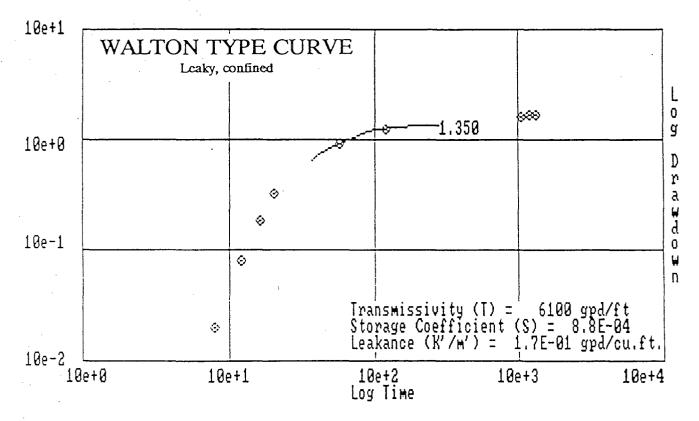
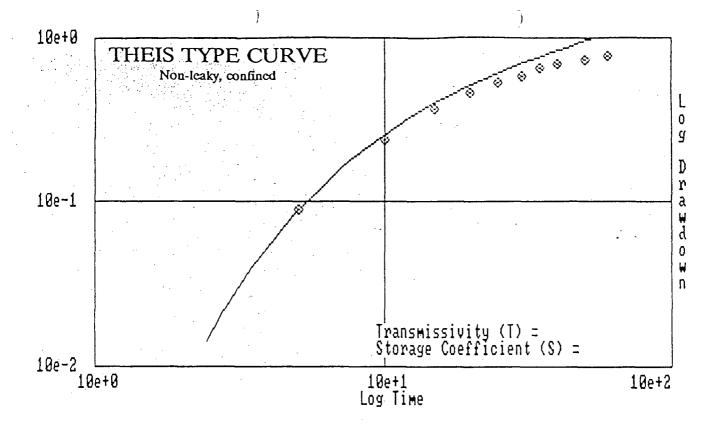


Figure 15

Drawdown data from MW-5.



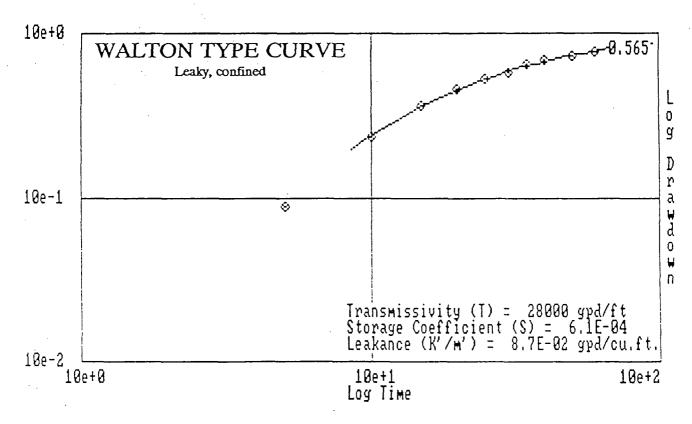


Figure 16

Drawdown data from MW-3

2.6 Ground-Water Contours of the Lower Overburden Aquifer

Ground-water contour maps were generated from data collected from the lower overburden aquifer monitoring wells at the start of the pumping test, and at 1380 minutes (optimum drawdown). Figure 17 represents ground-water contours prior to the start of the pumping test. This figure shows that the regional ground-water flow direction is generally towards the south. Figure 18 represents a contour map from data collected at 1380 minutes into the test. Changes in water levels (1380 minutes into test) were used to construct Figure 19. These figures reveal that pumping effects extend as far as MW-19 to the north, MW-11 to the south, and MW-20 to the southeast.

3.0 GROUND-WATER CHARACTERIZATION OF DISCRETE BEDROCK ZONES

Ground-water samples were obtained during the packer test to determine variations in ground-water chemistry within the target zones of the production well.

3.1 Discrete Zone Ground-Water Sampling

Water samples were collected from each of four discrete zones. The samples were retrieved from the pump discharge at the well head following one hour of pumping. The samples were appropriately bottled, labeled and preserved for analyses. A bottom-filling stainless steel bailer was utilized to retrieve a water sample from the bottom of the production well (250 feet) following completion of the packer test and removal of the packers. Field and trip blanks were obtained for QA/QC. Water samples were analyzed for VO+15 using U.S. EPA Method 624.

3.2 Ground-Water Chemistry

The ground-water samples were tested for ground-water quality parameters including, metals, cations, anions, conductance, pH, alkalinity, hardness and total dissolved solids. The results of analyses and Stiff diagrams developed from this data are available in Appendix B.

The results indicate that all of the zones tested produced ground water of similar chemistry with the exception of sulfates. Packer test #2 (115-130 feet) produced the highest concentration of sulfates. The water sample from this zone contained a very fine, black, suspended solid. The data suggests that this zone may have a different lithologic makeup than the other zones tested or may represent a structural change (i.e. fracture, bedding plane) containing altered mineralization. However, in general the chemistry data suggest that the zones are chemically similar which suggests hydraulic connection.

3.3 Volatile Analyses Results

Ground-water samples collected during the packer test were analyzed for VO+15 using Method 624. The results are provided in Appendix B and are summarized in the following table:

TABLE 3
VO+15 ANALYTICAL RESULTS, PACKER TEST
(results in ug/L, ppb)

PARAMETER	TEST 1 209-194 ft	TEST 2 130-115 ft	TEST 3 70-55 ft	TEST 4 40-25 ft
Trichloroethane	2 _j	6.08	6.58	7.4
Toluene	ND	2 _j	21.28	ND
Tetrachloroethene	4 _j	5.96	4 _j	3 _j
Methyl Tert. Butyl Ether (MTBE)	2 _j	2 _j	1 _j	2 _j

ND = Not Detected $X_i = Below Method Detection Limit$

Note: No other parameters (VO+15) were detected. Methylene chloride was detected in the laboratory blank.

4.0 CONCLUSIONS

Our conclusions, based on the data gathered during the production well packer and pump testing, are as follows:

The bedrock aquifer appears to be hydraulically connected to the lower overburden aquifer across the site. All of the lower overburden aquifer monitoring wells showed predictable response to pumping from the FO production well set in the bedrock aquifer. Water use from the bedrock aquifer may produce a ground-water gradient favorable to controlling the off-site horizontal migration of potential chemical constituents in the lower overburden aquifer.

The existing hydraulic gradient between the upper overburden aquifer and the lower overburden aquifer and the bedrock aquifer is upward during periods of little or no ground-water usage. During FO production well pumping (and water use) the gradient becomes downward in some areas. This could enhance migration of soluble chemicals into the bedrock aquifer from the lower overburden aquifer during periods of high ground water use.

It should be noted that the FO production well recirculates all water back to the well unless water is being used in the plant. Thus, under non-demand conditions, the actual drawdown in the production well is minimal even with the pump operating. While this recirculation may result in a ground-water flow pattern towards the production well within the immediate vicinity of the well (at depth) the effective zone of influence will not encompass the entire site.

The transmissivity calculated from the pump test data averages 2.1 X 10⁴ gal/day/ft, however the range covers an order of magnitude. The storativity values range from 2.4 X 10⁻³ to 6.1 X 10⁻⁴ and fall mostly within the range generally associated with confined aquifer conditions. The leakage value averages 1.9 X 10⁻¹ gal/day/ft³ and

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represents a) the cone of depression intersecting a recharge boundary, b) the effects of leakance through a confining unit, either above or below the aquifer zone tested, or c) directional flow through hydraulically dissimilar units within the aquifer (i.e. change from bedrock to unconsolidated soils, bedding plains, bedrock fractures, etc.). Of course leakage may be due to any combination of a,b and c.

The calculated transmissivity values represent the transmissivity of the lower overburden aquifer and the bedrock aquifer. As presented in The Lower Overburden Aquifer Injection Well Feasibility Report (dated April 8, 1992), the transmissivity of the lower overburden aquifer is approximately 470 gpd/ft. Tests of the FO production well are approximately 21,000 gpd/ft. Considering the approximate thickness of the lower overburden aquifer of 10 feet and the thickness of the bedrock aquifer at 200 feet, the bedrock aquifer is two to five times more permeable than the lower overburden aquifer.

The upper overburden aquifer is hydraulically isolated from the units referred to as the lower overburden aquifer and bedrock aquifer across the site except for the southeastern extreme near MW-17 and MW-1 and extending east to MW-20. Physical evidence from boring logs and indirect evidence from ground-water data indicates that the silty clay confining unit is thin or absent and is not effectively isolating the two units in this area.

Volatile organic compound analysis of ground-water samples from the four zones involved in packer testing show the presence of minor concentrations of a number of VOCs found in shallow soils and the upper overburden aquifer ground water. VOCs found show no apparent trend in concentration with depth nor is there any relationship to known degradation products of VOCs. VOC concentrations found are sufficiently low such that their presence in samples from the tested zones may not be representative of formation water. The peculiar manner in which the FO production

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well is used, the inability to verify isolation of each zone tested, and the low concentrations of VOCs found are all contributing factors.

The bottom sample from the production well does show the presence of VOCs. However, the lack of compounds that are more dense than water or the lack of concentrations near the constituent water solubility suggests that DNAPLs are not present in the vicinity of the well.

REFERENCES

Walton, W.C., 1962, Selected analytical methods for well and aquifer evaluation. Illinois State Water Survey Bulletin 49.

Cooper, H.H. and C.E. Jacob, 1946. A generalized graphical method for evaluating formation constants and summarizing well field history. Am. Geophys. Union Trans. Vol.27, pp.526-534.

APPENDIX A PUMP TEST DATA

92KW2027.T1



LOCATION: Lod, NJ	CLIENT:	Leviel 61064
TEST TYPE: CONSTANT TOTE	DATE:	4-23-92 TO: 4-24-92
PUMPING WELL: FO - Production (PW)	PUMP:	
FLOW MEASUREMENT: 51000 METER	PAGE .	1 OF 7
THE COURT OF AN AND AND AND AND AND AND AND AND AND		

STANCE F	ROM PU	MPING WE	LL:		••					
Time	Q (gpm)	PW DTW (ft)	MW-3 DTW (ft)	MW-5 DTW (ft)	MW-7 DTW (ft)	MW-9 DTW (ft)	MW-11 DTW (ft)	MW-13 DTW (ft)	MW-15 DTW (ft)	MW-17 DTW (ft)
1445		4.60	10:25	11.12	9.52	8.70	9.43	9.55	9.75	9.06
15	<u>, </u>	6.00								
30	140	1375								
45		16.25								
1446		17.75								
15		19.75				·				
3.3		21.30								
· 44<		22.00								
1447		23.00			9.85					
15		2375			!					
30		24.5								
uS		25.25								
1448		70.25				8.82				
٠ ج		20.75		:						
د <i>د</i> .		27.00								
ي ج		27.20					ļ			
14019	<u> </u>	7753						ļ	ļ	
.<		22.2						_		
3.0		72, 33					ļ	ļ	ļ	
. 3		73.20						ļ		ļ
10 5 2		7 25 5	10.37	11.14		9.00	ļ	<u> </u>	ļ., <u>.</u>	9,12
4		73.05						<u> </u>		
3 49		7 3 30				ļ	ļ	<u> </u>	<u> </u>	ļ
25		72.00			<u> </u>	<u> </u>	<u> </u>			
1451		70.70			10.00		ļ		<u> </u>	
15		22.23	T			ļ <u>-</u>		ļ		
દુક	<u> </u>	V^ +⊃	<u> </u>				<u> </u>		<u> </u>	
45		79.50								<u> </u>
1452		29.90								



TT. Hara TO Ha
TE: 4-23-92 TO: 4-24-92
MP:
GE <u>2</u> OF 7

STANCE	ROM PU	MPING WEI	∟∟: ===		 				,	
Time	Q (gpm)	PW DTW (ft)	MW-3 DTW (fi)	MW-5 DTW (fi)	MW-7 DTW (fi)	MW-9 DTW (ft)	MW-11 DTW (ft)	MW-13 DTW (ft)	MW-15 DTW (fi)	MW-17 DTW (fi)
452 15		29.85								
- २०		29.85				: :				
45		79.95								
1453		30.00	·		10.10	9.13				
15		30.10								
30		30.20								
45		30.10						<u> </u>		
1454	-	30.20								
30		30.25				<u>:</u>				
1455		30.50	10.57	11.20			10.12			9.15
30		30.≤0								
1456		30.53				9.23		11.49		
30		30.60								
1457		30.75		:	10.20					
3 5		30.35								
1258		30.35						·	10.13	
30		30.75								
1459		30 90				9.30				
30		31.00								
1500		31 30	10 55	1, 7,1	10,58					3 ,
ノマンド		5, 50								
1507		7,000			10.32	9.36				
1503		31.25								
15.04		3135				9.40				
15.05		31.40	10.74	11.45	10.37		12.23			9.16
در <i>ال</i>		31 45						11.38		
/9.37		31.50			10.41	9.42				
1508		31.65							10.53	
1509		31.70				9.44			1	



LOCATION: Lodi NI	CLIENT:	Hercel Leisun
TEST TYPE: Congrave Rate	DATE:	41-72-92 TO: 41-24-42
PUMPING WELL: FO-POOLUTION (PW)	PUMP:	
FLOW MEASUREMENT: Flow Murice	PAGE	3 OF 7
DISTANCE FROM PUMPING WELL:		•

Time	Q (gpm)	PW DTW ((i)	MW-3 DTW (ft)	MW-5 DTW ((i)	MW-7 DTW ((t)	MW-9 DTW (ft)	MW-11 DTW (ft)	MW-13 DTW ((i)	MW-15 DTW (ft)	MW-17 DTW (ft)
1510		31.75	10.31	11.53	10.43					9.17
1511		31 75								
1512		31.75				9.48				·
1513		31.75			10,46					
1514		31.75				9.49				
1515		31.80	10.36	11.71			10.34	12.04		9.17
1516		31 80			10.50					
1517		31.85								
1513		31.85				9.51				
1519		31.90			10.52	: .			1006	
1520		3195	10.93	11.83		: 				9.18
1521	140	31.95				9.54				
1572		3195			10.53			···		
1523		32 00		2		9 55				
1524		32 00.			10.55					
1252	ļ	3190	15.6	11.33			10.39			3 , <u>c</u>
1526		32.0				9.50				
1527		37.15	,		10.56			2 - 13		
573		37.10								
11.00		70 1				3 57			17.7-	
1533		35 25	10 25	11.00	10.53					2 2 5
1531		37.15								
1537		32.13				9.53				
1533		32.15			10.60]			
1534		32 10								
1535		37.30	11, 31	12.07		9.59	10.44			9.20
1536		32.5			10.60					
1537		32.22			1					
15.38		32.15				9.60				



LOCATION: Lod: NIZ	CLIENT:	Idexcel WOUN
TEST TYPE: CONSTONT RATE	DATE:	4-22-92 TO: 4-24-92
PUMPING WELL: FO - Production (PW)	PUMP:	
FLOW MEASUREMENT: Flow METICA	PAGE	4_OF_7_
DISTANCE FROM PUMPING WELL:		•

Time	Q (gpm)	PW DTW ((i)	MW-3 DTW (ft)	MW-5 DTW ((i)	MW-7 DTW (ft)	MW-9 DTW (ft)	MW-11 DTW (ft)	MW-13 DTW (ft)	MW-15 DTW ((t)	MW-17 DTW (ft)
1539		32.15			10.62					
1540		32.20	11.03	12.07						9.21
1541		32.20								
1547		32.20			10,62	9.61				
1543		32.20								
1544		37.30				9.62				
.1545		32 25	11.35	12.12	10.64	·				9.72
1615	130	37.60	11.14	12.27	10.70	9.66	10.49	12.29	10.86	9.29
1645	140.	77.00	11.19	12.37	12.74	9.71	19.53	12:33	10.91	9.35
17,5	140	33.00	11.23	12.42	10.78	9.74	10.54	17.36	10.92	9.41
1745	140	33.00	11.26	12.00	10.80	9.75	10.57	12.39	10.96	9.45
4.74.42										
0315	100	33.80	11.46	12.77	11.02	9.93	10.78	12.62	11.16	9.56
0945	133	31.30	11.49	12 79	11.03	10.00	10 30	12.61	11.15	9.59
1545	140	34.60	11.50	12 79	11.23	₹e C1	10.81	17 74	11.76	9.5B
1145	143	35.60	11.53	12 82	h., ,	13.00	10 93	12.76	11.28	9.53
120	143	35.30	11.54	12 85	11 70	10.05	10.33	12.75	11.27	9.00
1345	145	३ ∢.२०	11.56	17 33	11 2	15 07	10 25	12.78	11.35	0.52
1430		3< 00	11.53	17 38	19	1006	10.84	12.77	11.29	از د
,							*.			



7

LOCATION: Lodi, NJ	CLIENT:	Hercel 15104
TEST TYPE: CONSTANT RATE	DATE:	4-27-92 TO: 4-24-92
PUMPING WELL: FO- P. Nam (PW)	PUMP:	
FLOW MEASUREMENT: FISH MITTER	PAGE	5 OF 7
DISTANCE FROM PUMPING WELL:		•

Time	Q (gpm)	MW-19 DTW ' ((t)	PI DTW (ft)	* MW-1 DTW (ft)	• MW-20 DTW (ft)	·				
1445		7.04	5,72	9.98	4.99	[
1440					÷					
1447			5.80		,					
1448										
1449			6.00							
1450										
1451										
1452		:	6 .14							
1455									·	
1454			6.26	! !						
1455					4.99					
1456										·
1457										
1453			637	;						
1459										
1500										
1501			6 23							
1502			ļ					ļ		
1503			6.48					ļ	ļ	
15 34			-	`				ļ		
1505			<u> </u>		4.99			ļ	ļ <u></u>	
ئ <i>5</i> 57	ļ		6.51					ļ		
1507	ļ				-					
1509			6.54							
15:09	ļ	ļ			ļ					
1510	<u> </u>									
1511	<u> </u>	<u> </u>	6.58			-		-		
1512	ļ		<u> </u>							:
1513		<u> </u>	6.60	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>		



LOCATION: Lod NI	CLIENT:	Hexcel 61064
TEST TYPE: Constant Este	DATE:	4-23-92 TO: 4-24-92
PUMPING WELL: Fo- Production (PW)	PUMP:	
FLOW MEASUREMENT: 61000 mirror	PAGE	6 OF 7
DISTANCE FROM PUMPING WELL:		

ISTANCE	FROM PU	MPING WE	LL:		,		 	
Time	Q (gpm)	MW-19 DTW (ft)	PI DTW (ft)	* MW-1 DTW (ft)	MW-20 DTW (ft)			
1514								
1515		!		10.40	5.00			
1516								
1517			662					
1.518								
1514			·					
1570			6.64				<u> </u>	
1521							 	
1522				-				
1523		·	6.66					
1524								
1525			6.67		5.00			
1526								
1527				:				
1528			6.03					
1529								
1530								
1531			6.69					
1532								
1500								
15711			6.70					
1535					5 01	ļ		
1576								
7537			6.71					
1578								
1539								
1545			6.72					
1541								
1542								
				******			 	 0.40000



EST TY UMPIN LOW N	YPE: IG WE ⁄IEASU	LL: FO IREMEN MPING WE	- Produ. VT: Floor	Tim (P	~)	CLII DAT PUN PAG	IP:		- TO:4-	
Time	Q (gpm)	MW-19 DTW ((t)	PI DTW ((i)	• MW-1 DTW (ft)	• MW-20 DTW (ft)					
1543			しご73					_		
1544										
1545	,			10.14	5.02	•				
1615			6 80	10.22	5.04					
1645		8.95	6.83	10.28	5.06					
1715		8.67	6.86	10.32	5.07					
1745		8.70	6 89	1036	5.08					
4-24-92							,			
0815		५,५०	7.11	10.49	5.19					
0945		3.37	7.13	10.50	5.19					
1045		8.91	7.10	10,50	5.19					
1145		9,52	7.18	10.51	5.19					
1245		8,99	7.20	10.51	5.19					
1345		9.01	7.70	10.55	5.19					
1430		9.00	7.19	10.53	5,19					
	<u></u>									
							·			
ļ										
					·					
([T	1		1					1	1

DAY Time		UMP Tr	me PW	,	MW-7	MW-7 LEVEL	MW-e	MW-9 LEVEL	MW-11	MW-11 LEVEL	MW-6	MW-6 LEVEL	MW-1	MW-1 LEVEL	MW-12	MW-12 LEVEL	MW-13	MW-13	MW-14	MW-14 LEVEL	MW-15	MW-15 LEVEL	
		,																					
· 22 14:24	4.026 21,586	21.9	14:24											•									. :
22 14.28 22 14.32	4.002 21.542 3.995 21.535	21.9 21.9	14:28 14:32	5,76														-					. :
22 14:36 22 14:40	3.994 21.534 4.002 21.642	21.9 21.9	14:36 14:40	•															•				. :
22 14:44 22 14:48	4.028 21.668 4.026 21.566	21.9 21.9	14:44 14:48																			7	
22 14;52 22 14;58	4.006 21.545 4.002 21.542	21.9 21.9	14:52 14:56																	-			٠.
22 15:00 22 15:04	3.995 21,535 3.995 21,535	21.85 21.85	15:00 15:04	5.76 5.76											10.3 10.3	20.71 20.71	·		11 <i>2</i> 9 11 <i>2</i> 5	19.41	8.82 8.62	21,95	
22 15:06 22 15:12	3.995 21.535 3.997 21.537	21.85 21.85	15:08 15:12	5,76											10.3	20,71			1124	19.46	8.82	21,95 21,95	
22 15:16 22 15:20	3.997 21.537 3.995 21.535	21,85 21,85	15:16 15:20	5.76 5.76											10.3 10.3	20,71 20,71			11.24 11.24	19.46	8.82 8.82	21.95 21.95	
22 15:24 22 15:28	3.995 21,535 3.997 21,537	21.85 21.85	15:24 15:28	5,76											10.3	20.71			1123	19.47	8.82	21.95	
22 15:32 22 15:36	3.997 21.537 3.997 21.537	21.85 21.85	15:32 15:36	5.76											10.3	20,71			1123	19.47	8.82	21.96	٠.
22 15:40 22 15:44	3.996 21.536 3.996 21.535	21,85 21,85	15:40 15:44	5.76										•	10.3	20.71			1123	19.47	8.82	21.95	
22 15:48 22 15:52	3.995 21.536 3.997 21.537	21,85 21,85	15:48 15:52	5.78											10.3	20,71			11.23	19.47	8.82	21.05	, ,
22 15:56 22 16:00	3.997 21.537 3.997 21.537	21.85 21.85	15:56 16:00	5.76											10.3	20,71			1123	19.47	8.82	21.95	
22 18:04 22 18:08	4.007 21,547 3.966 21,526	21.9 21.9	16:04 16:08																				
22 16:12 22 16:16	3,965 21,505 3,96 21,49	21.9 21.9	16:12 16:16				•												•				
22 16:20 22 16:24	4.015 21.556 4.127 21.667	21.9 21.9	16:20 16:24																				
22 16.28 22 16.32	4.128 21,668 4,084 21,624	21.9 21.9	16:28 16:32																•				
22 16:36 22 16:40	4.069 21.609 4.071 21.611	21.9 21.9	16:36 16:40																				
22 16:44 22 16:48	4,063 21,603 4,046 21,585	21.9 21.9	16:44 16:48																				
22 16:52 22 16:56	4.009 21.549 3.992 21.532	21.9 21.9	16:52 16:56	. 20															1122	19.48	8.8	21.97	
22 17:00 22 17:04 22 17:08	3.984 21.524 3.978 21.518	21,85 21,85	17:00 17:04	6.78 5.77											10.3 10.3	20,71 20,71			1122	19.48	8.83	21,94	
22 17;08 22 17;12 22 17;16	3.974 21.514 3.969 21.509 3.974 21.514	21,85 21,85 21,85	17:08 17:12 17:16	6,76											40.0				1121	19.49	8.84	21,93	
22 17.16 22 17.20 22 17.24	4.008 21.548 4.017 21.557	21,86 21,85	17:20 17:24	6,75											10.3	20,71 20,71				40.40			
22 17:28 22 17:32	4.018 21,558 4.028 21,568	21,85 21,85	17:28 17:32	6,70												20,71			1121	19.49	8.83	. 21.94	
22 17:36 22 17:40	4.036 21.576 4.037 21.577	21.65 21.85	17:36 17:40	5.76											10.3	20,71			11.22	19.48	8.8	21.97	•
22 17:44 22 17:48	4.023 21,663 4.014 21,664	21.85 21.85	17:44 17:48	5.75											.02	20,71					0.2	21.07	
22 17:52 22 17:68	4,006 21,548 4,009 21,549	21.85 21.85	17:52 17:56				•												1121	19.49	8.82	21.96	
22 18:00	4.049 21.589 4.063 21.803	21,85 21.9	18:00 18:04	5.76											10.3	20.71							
22 18:04 22 18:08 22 18:12	4.058 21.598 4.051 21.591	21.9 21.9	18:08 18:12																•				
22 16:16 22 18:20	4.051 21.691 3.996 21.635	21,85 21,85	18:16 18:20	6.73											10.3	20,71			1121	19.49	8.78	21.99	
22 18:24 22 18:28	3.961 21,501 3.945 21,485	21.85 21.85	18:24 18:28	5.77											10.3	20,71			1121	19.49	8.84	21,93	
22 16:32 22 18:36	3.934 21.474 3.929 21.489	21.85 21.85	16;32 18;38	5.7B											10.3	20.71			1121	19.49	8,88	21.89	
22 18:40 22 16:44	3.927 21.467 3.925 21.465	21.86 21.85	18:40 18:44	5.79											10.3	20,71			1121	19.48	8.89	21.88	
22 18:48	3.922 21.462 3.927 21.467	21.85 21.85	18;48 18;52																				
22 18:52 22 18:55 22 19:00	3.925 21,465 3.927 21,467	21.86 21.85	18:56 19:00	6.7B											10.3	20,71			1121	19.49	8.68	21.89	
22 19:04 22 19:06	3.927 21.467 3.927 21.467	21.85 21.85	19:04 19:06						•										•				
22 19:12 22 19:16	3.927 21.467 3.926 21.466	21.85 21.85	19;12 19;16	5.79											10.3	20.71		•	1121	19.49	88.8	21.89	
22 19:20 22 19:24	3.956 21.496 3.977 21.517	21.9 21.9	19:20 19:24																,				
22 19:28	4,008 21,548 4 21,54	21.9 21.9	19:26 19:32																				
22 19:32 22 19:36 22 19:40 22 19:44 22 19:62 22 19:62 22 19:66 22 20:00	4 21.54 4.02 21.56	21.9 21.9	19:36 19:40																				
22 19:44 22 19:48	4,03 21,67 4,035 21,575	21.9 21.9	19:44 19:48																				
22 19:52 22 19:56	4,037 21,577 4,037 21,677	21.9 21.9	19:52 19:56																				
22 20:00 22 20:04	4.04 21.58 4.041 21.581	21.9 21.9	20 00 20 04																				
							•																

884080045

DAY	Time		MW-13	PUMP ON/OFF	Time	PW	MW-7	MW-7 LEVEL	MW-9	MW-9 LEVEL	MW-11	MW-11 LEVEL	MW-6	MW-5 LEVEL	MW-1	MW-1	MW-12	MW-12 LEVEL
. :	23 02:0 23 02:0 23 02:0	4 4.214 6 4.215	21.75 21.75	4 21.9	02:00 02:04 02:08													
	23 02:1 23 02:1 23 02:2	6 4.202	21.74	2 21.9	92:12 92:16 92:20													
:	23 02:2 23 02:2 23 02:3	4 4.2 6 4.195	21.7	4 21.9 6 21.9	02:24 02:28 02:32							٠						
:	23 02:4 23 02:4 23 02:4	6 4.192 0 4.192	21,73	2 21.9 2 21.9	02:36 02:40 02:44													
	23 02:4 23 02:6	8 4.2 2 4.202	21,74 21,74	4 21.9 2 21.9	02:48 02:52													
:	73 02:5 23 03:0 23 03:0	0 4 <i>2</i> 02 4 4 <i>2</i>	21.74	2 21.9 4 21.9	02:56 03:00 03:04													*
	23 03:0 23 03:1 23 03:1	2 4,192	21.73	2 21.9	03:08 03:12 03:18												•	
	n 032 n 032 n 032	4 4.187	21.72	7 21.9	03:20 03:24 03:28													
:	73 03:3 73 03:3 73 03:4	2 4.185 5 4.183	21.72	3 21.9	03:32 03:36 03:40													
:	23 03:4 23 03:4 23 03:6	4 4,183 8 4,185	21.72	3 21.9 6 21.9	03:44 03:48 03:52													
- 3	3 03:5 3 04:0	4.187 4.185	21.72 21.72	7 21.9 5 21.9	03:56 04:00 04:04													
	r3 04:0 r3 04:1	8 4.187 2 4.187	21.72 21.72	7 21.9 7 21.9	04:08 04:12													
	3 04:1 3 04:2 3 04:2	0 4.187 4 4.192	21.72	7 21.9 2 21.9	04:16 04:20 04:24													
	3 042 3 043 3 043	2 4.197 5 4.196	21.73	7 21.9 5 21.9	04:28 04:32 04:38													
2	3 04:4 3 04:4 3 04:4	4,193	21.73	3 21.9	04:40 04:44 04:48													
2	3 04:5 3 04:5 3 05:0	2 4.2 3 4.202	21.74 21.74	4 21.9 2 21.9	04:52 04:58 05:00													
	3 06:0 3 06:0 3 05:1	4.202	21.742 21.742	2 21.9 2 21.9	05:04 06:08 05:12													
2	3 05:1 3 05:2	42	21.74	1 21.9 1 21.9	05:16 06:20													
•	3 052 3 052 3 053	4.202	21.742 21.742	21.9	05:24 06:28 06:32													
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2 2	3 05:4 3 05:5	4.229 4.231	21.769 21.771	21.9 21.9	05:48 05:52 05:66													
	3 06:0 3 06:0	4.233 4.238	21.773 21.778	21.9	06:00 06:04 06:08													
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2 2 2	3 06:44 3 06:53	4.26 4.236	21.81 21.8 21.776	21.9 21.9	06:44 06:48 06:52													
2 2 2	07:00	4,197	21,749 21,737 21,744	21.9	06:56 07:00 07:04													
2 2 2	3 07:00 3 07:10 3 07:10	4.248 4.231 4.265	21,788 21,771 21,795	21.9 21.9 21.85	07:06 07:12 07:16	5.7											10.3	20.71
2 2 2	3 07.24 3 07.24	4.241 4.206	21.781	21.85 21.85	07:20 07:24 07:28												10.3	20.71
2 2 2	3 07:33 3 07:34	4.2	21.74	21.9 21.85	07:32 07:36 07:40												10.3	20.71
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MW~14 LEVEL

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23 18:15 1265 18.803 18:19
23 18:23 128 18:8 18:23
23 18:27 1258 18:796 18:27
23 18:35 1248 18:796 18:27
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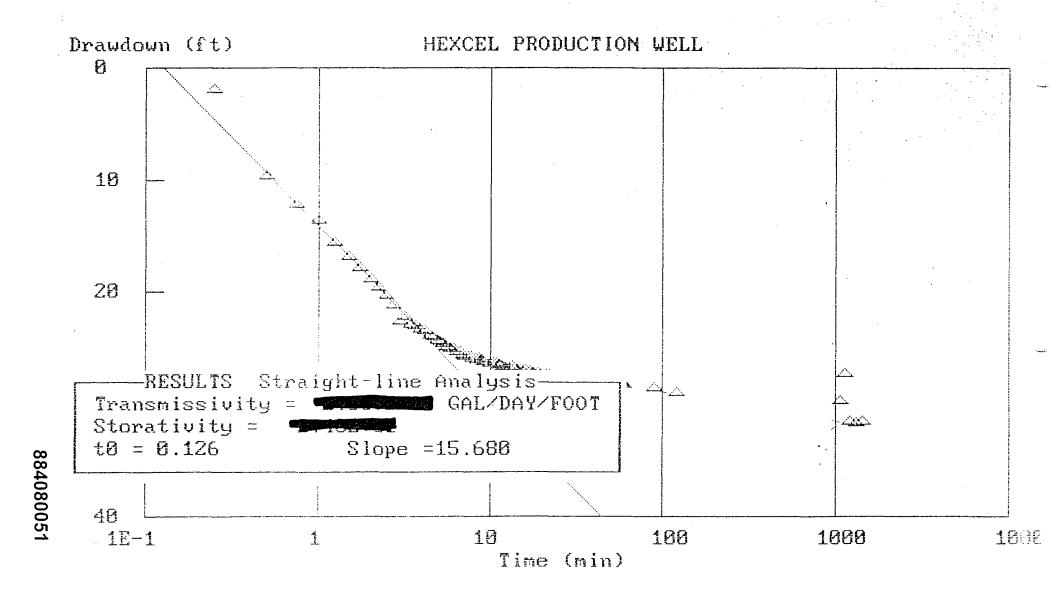
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DAY Time MW-13 PUMP ON/OFF	Time PW	MW-7 MW- LEVE		MW-11 N	W-6 MW-6	MW-1	/~12 MW-1 VEL	LEVEL
23 19:25 12:18 18:758 23 19:29 12:15 18:755 23 19:43 12:15 18:755 23 19:47 12:16 18:755 23 19:47 12:16 18:755 23 19:51 12:13 18:753 23 19:55 12:13 18:753 23 19:56 12:09 18:749 23 20:03 12:08 18:748 23 20:07 12:06 18:748	19:35 19:39 19:43 19:47 19:51 19:55 19:59 20:03 20:07			·				
23 20:11 1204 18744 23 20:19 1203 18743 23 20:21 1203 18743 23 20:23 1203 18743 23 20:21 1203 18743 23 20:31 1202 18742 23 20:35 1203 18743 23 20:36 1203 18743 23 20:36 1203 18743 23 20:36 1203 18743 23 20:43 1:99 18738 23 20:43 1:99 18737 24 20:55 1:99 18732 25 20:55 1:99 18732 26 20:55 1:99 18732	20:11 20:15 20:19 20:25 20:27 20:31 20:36 20:39 20:43 20:47 20:51 20:55 20:59	·						
23 21:03 1.986 18.726 23 21:07 1.984 18.724 23 21:11 1.18 18.722 23 21:11 1.78 18.718 23 21:19 1.776 18.716 23 21:23 1.776 18.716 23 21:23 1.776 18.716 23 21:31 1.776 18.715 23 21:35 1.73 18.713 23 21:35 1.73 18.713 23 21:43 1.771 18.711 23 21:43 1.771 18.711 23 21:43 1.771 18.711 23 21:45 1.77 18.71 23 21:56 1.17 18.71 23 21:56 1.17 18.71	21:03 21:07 21:11 21:15 21:19 21:23 21:27 21:31 21:35 21:39 21:43 21:47 21:51 21:56							
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23 23:51 1.14 18.68 23 23:55 1.34 18.68 24 20:25 1.37 18.677 24 00:07 1.37 18.677 24 00:07 1.37 18.677 24 00:07 1.37 18.677 24 00:15 1.35 18.675 24 00:15 1.35 18.675 24 00:19 1.33 18.673 24 00:27 1.34 18.674 24 00:27 1.34 18.675 24 00:35 1.35 18.675 24 00:35 1.35 18.675 24 00:35 1.35 18.675 24 00:35 1.35 18.673 24 00:35 1.35 18.673 24 00:43 1.33 18.673 24 00:43 1.33 18.673 24 00:43 1.35 18.673 24 00:43 1.36 18.675 24 00:55 1.29 18.669 24 00:55 1.29 18.669 24 00:55 1.29 18.669 24 01:07 1.28 18.669 24 01:07 1.28 18.669 24 01:07 1.28 18.669 24 01:07 1.28 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.29 18.669 24 01:11 1.20 18.669 24 01:11 18.	23.51 23.56 23.59 00.03 00.07 00.11 00.15 00.23 00.27 00.31 00.36 00.43 00.47 00.51 00.55 01.03 01.07 01.11							

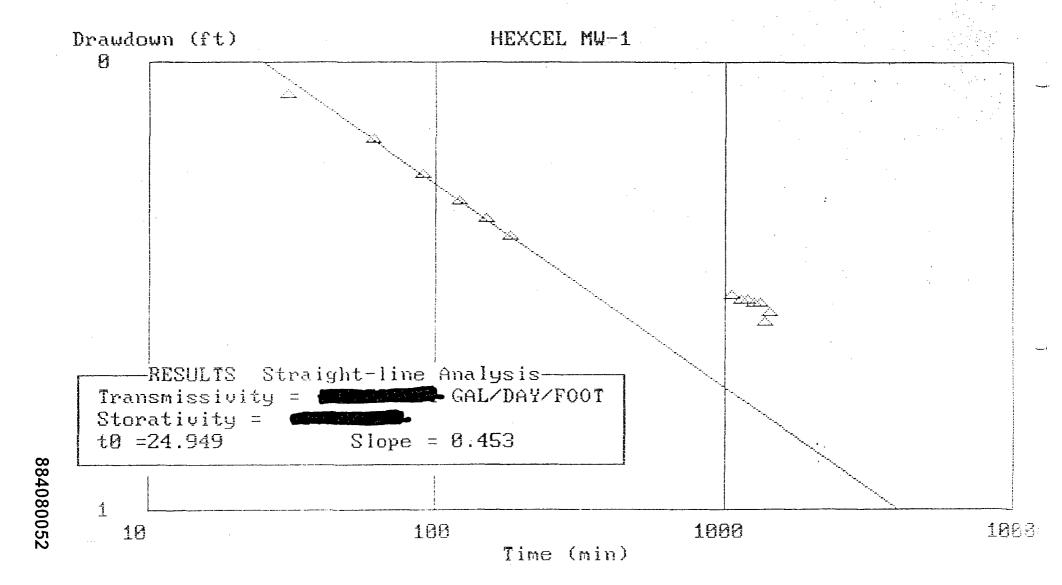
MW-14 LEVEL

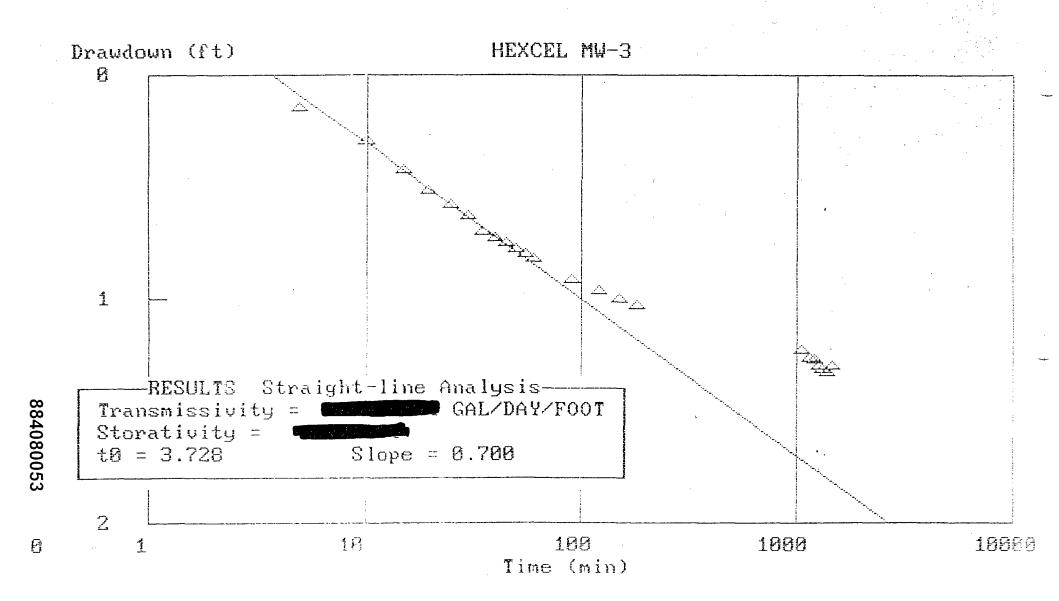
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	24	01:27	1,125	18.66			127							••						,	•
•	24 24	01:31 01:36	1.124	18.66 18.66	5	01	:31 :35														
	24 24	01:39 01:43	1,124 1,124	18.66- 18.66-	4	01	1:39 1:43														
	24 24	01:47 01:51	1.125 1.123	18,660 18,660			1:47 1:61														
	24 24	01:55 01:59	1.123	18.56	3	. 01	:55 :59														
	24	02:03	1.12	18.66	3	02	:03														
	24 24	02:07 02:11	1.122	200.91 20.81	5	02	::07 ::11							•						- 1	
	24 24	02:15 02:19	1.12	18.66			::16 ::19														
	24 24	02:23 02:27	1,119	18.656 18.657			23														
	24	02:31 02:35	1.116	18.656	3	02	31														
	24	02:39	1.113	18.650 18.653	3	02	:39														
	24 24	02:43 02:47	1,113	18.651 18.651	3		:43 :47														
	24 24	02:51 02:65	1,111	18.551 18.549	l 9		:51 :56														
	24 24	02:59 03:03	1,106	18.646 18.646		02	:69														
	24	03:07	1,106	18.546	5	03	:07													•	•
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	24 24	03:19 03:23	1.102 1.101	18.641	١	03	:19 :23				٠.										
	24 24	03:27 03:31	1,101	18.641			:27														
	24 24	03:35 03:39	1.101	18.641 18.641	t	03	:36														
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	24 24	05:03 05:07	1.089 1.086	18.629)		:03														
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	24 24	05:39 05:43	1.063 1.06	18.523 18.52		06 06:															
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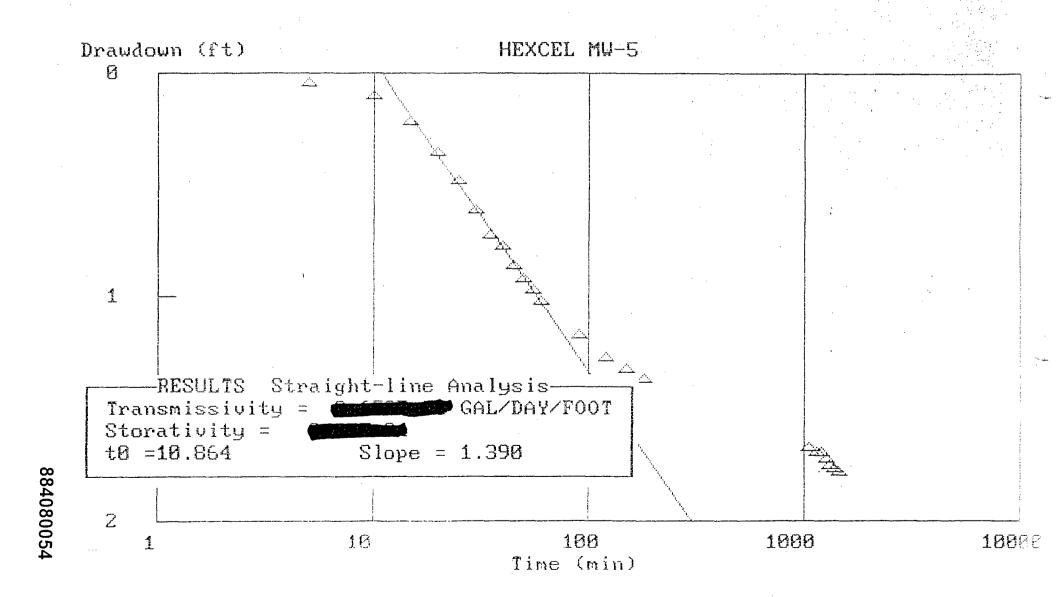
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24 0727 1073 1074 1075 1076 1077 1076 1077 1077 1077 1077 1077					DOM:														
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24 17 18 18 18 18 18 18 18																			
3-4 07-45 1677 16207 07-51 162	2				619												*		
324 075 160 160 160 160 075 16	2	4 07:4	3 1.07	7 18/	617	07:4	13												
24	2	4 07:4 4 07:5			614 607														
24	2	4 07:5	5 10	5 1	8.6	07:5	-6												
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24		4 08:1	9 1.07	2 18/	512 512								10.78	20	1277	1973	10.49	21.93	
24	24	4 082	3 1.06	9 18.6	509	08:2	3												
24								7 11	. 110	2 19.56		19.85				,			
24	2	4 08:3	5 1.04	8 18	586	06:3	6												
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24			7 1.05	9 182	500														
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24 09:30 1064 18:594 09:00 -																			
24	24	4 09:0	1.05	4 18	594	09:0	3.												
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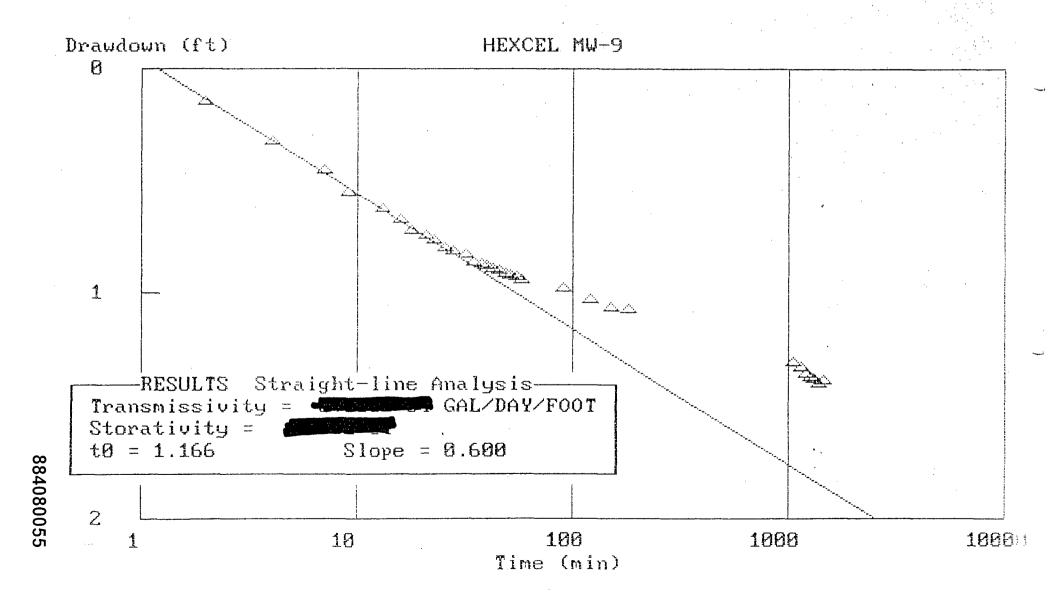
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DAY	Time	•		MW-13	PUMP ON/OFF	Time	PW		MW-7	MW-7 LEVEL		MW-8	MW-11	MW-11 LEVEL	MW-6	MW-6 LEVEL	MW−1	MW-1 LEVEL	MW-12	MW-12	MW-13	MW-13 LEVEL	MW-H	MW-14 LEVEL	MW~16	MW-15 LEVEL
	24 24 24 24 24 24 24 24 24 24 24 24 24 2	13:11 13:23	0.928 0.929 0.919 0.919 0.919 0.919 0.919 0.916 0.916 0.916 0.916 0.916 0.916 0.916 0.916 0.921 0.923 0.926 0.926 0.926 0.926 0.927 0.927 0.927 0.928	18 A66 18	6 9 1 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	13 13 13 13 13 13	31 33 33 34 37 11 15 18 33 34 37 11 15 18 33 7 11 15 18 33 7 11 15 18 33 7 1 15 18 18 33 7 1 15 18 18 18 18 18 18 18 18 18 18 18 18 18	7.19 7.19 7.19 7.19 7.10 7.00 6.56 6.54 6.33 6.3 6.37 6.14 6.12 6.16 6.15	11.11 10.94 10.74 10.85 10.40 10.28 10.15 10.15 10.10 10.07	19.57 19.74 19.94 20.02 20.35 20.4 20.4 20.5 20.55 20.55 20.55 20.55 20.55	10.07 9.82 9.82 9.44 9.39 9.30 9.20 9.21 9.16	19.76 20.01 19.73 20.31 20.39 20.44 20.53 20.65 20.65 20.65 20.67	10.84	19.94	12.86 12.87 12.83 12.89 12.54 12.21 12.00 11.90 11.91 11.85 11.75	19.54 19.53 19.57 19.81 19.96 20.29 20.42 20.51 20.55 20.65 20.75	10.53 10.52 10.5 10.44 10.44 10.37	21.87 21.89 21.92 21.94 21.98 22.02 22.06								

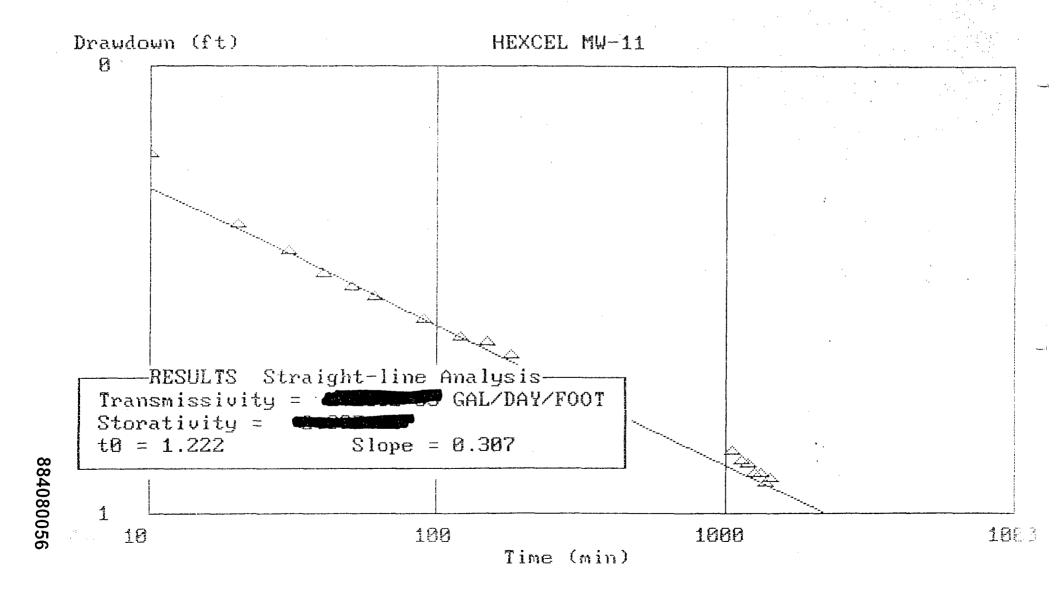


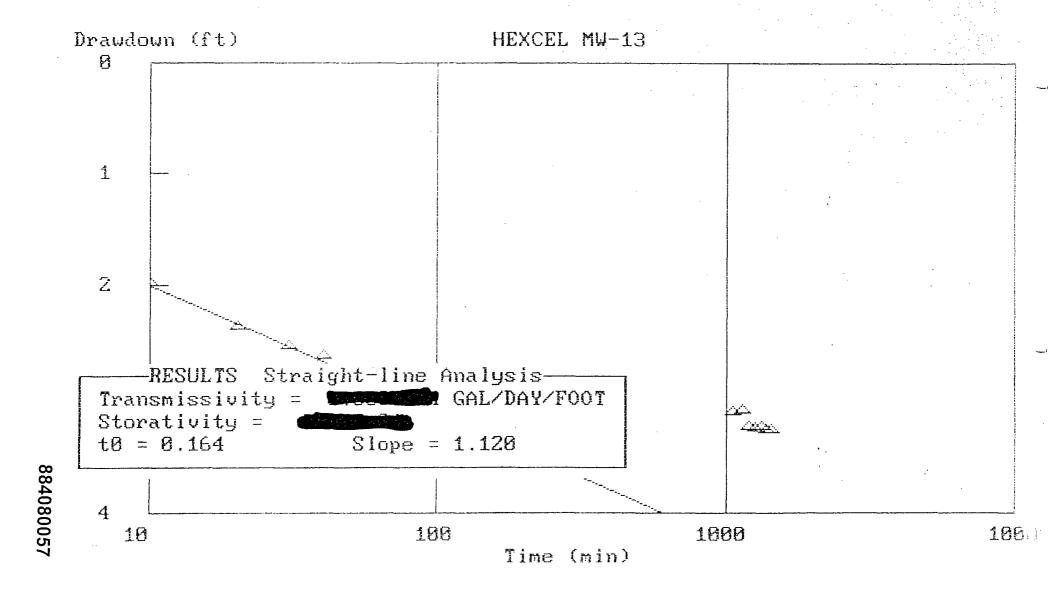


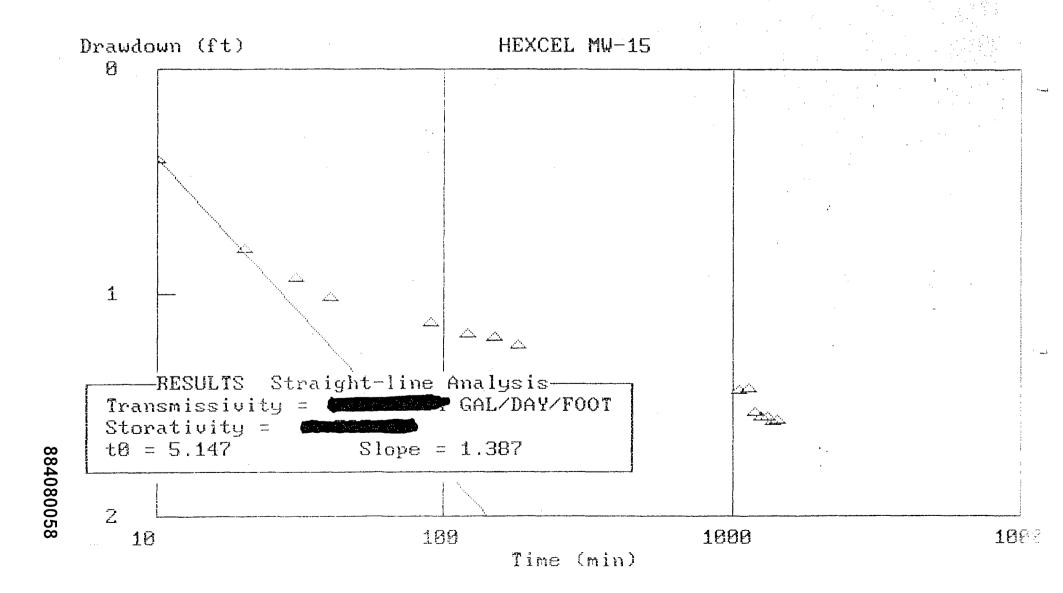


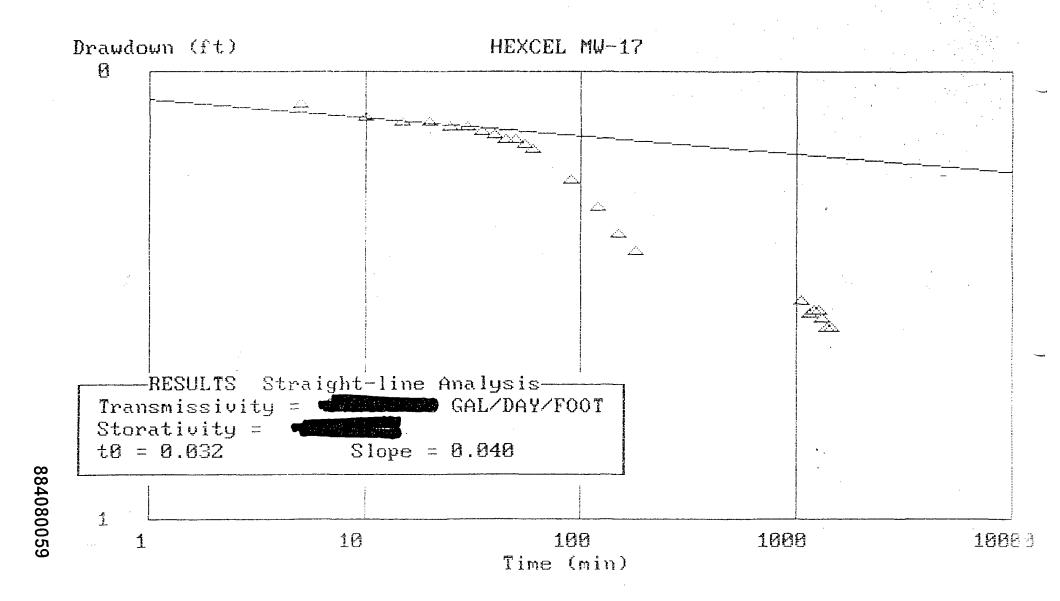


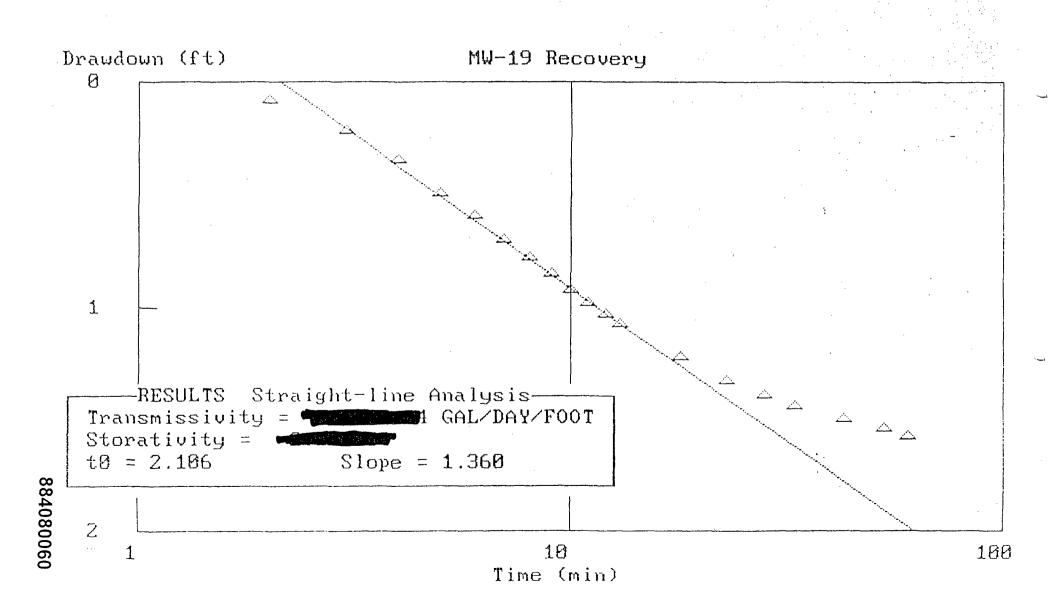


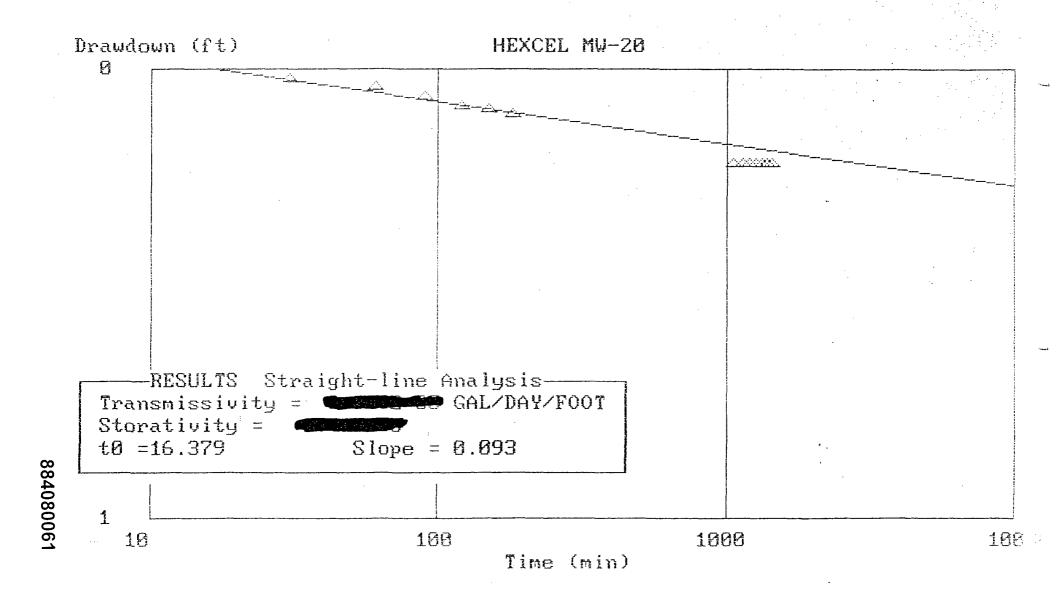


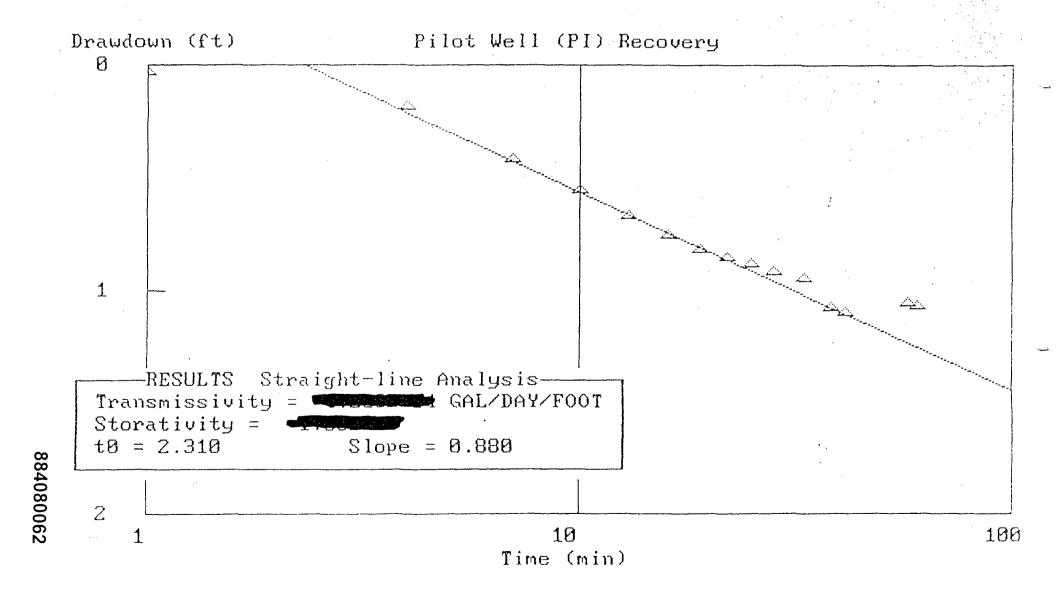








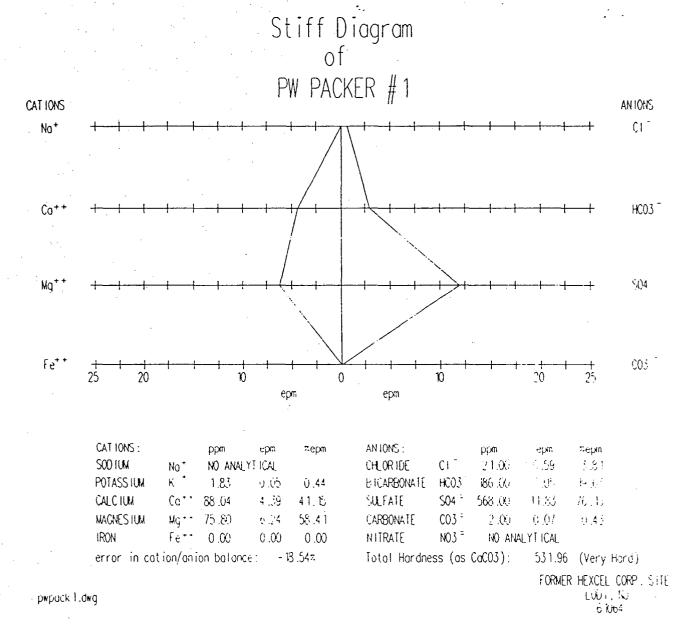




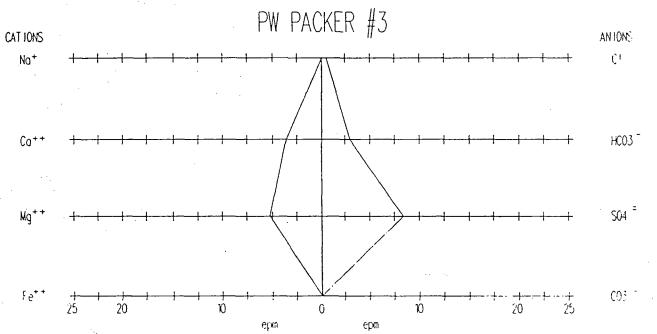
APPENDIX B LABORATORY ANALYTICAL REPORTS

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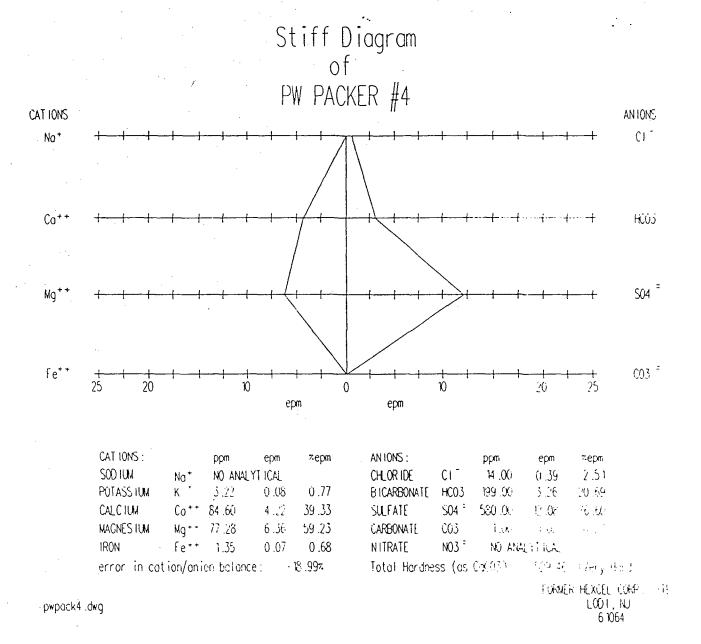


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POTASS IUM	K +	1.75	0.04	0.49	ELICARBONATE	HC03	186,00	3.05	,4 .b(-
CALCIUM	Ca++	73 .84	3 .68	40.43	SULFATE	504	393.00	8, 20	fg 55
MAGNESIUM	Mg++	65 .44	5.38	59.07	CARBONATE	(03	α	0.07	J. 50
IRON	Fé++	0.00	00.00	0.00	NITPATE	NO3 =	NO ANA	LYTICAL	
error in ca	t ion/ani	on balanc	:e: - 13	.30%	Total Hardrie	ess (us	Catu3 r:	453.34	(Verv

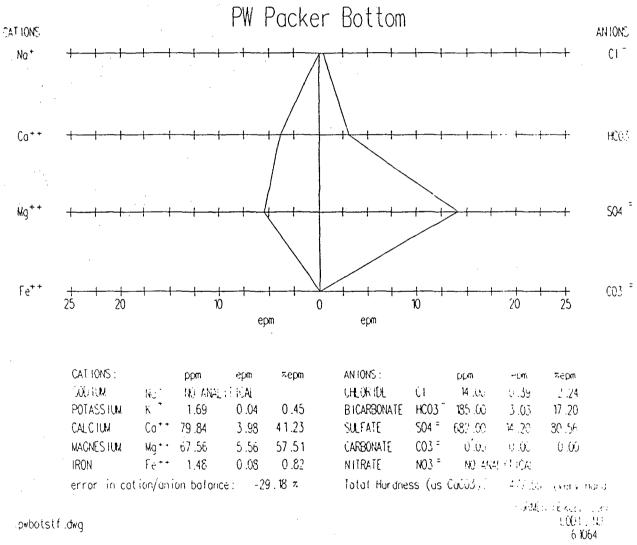
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FORMER HEXCEL CORP. SITE LOOT, NJ 61064

pwpack3.dwg



Stiff Diagram of



pwbotstf.dwg

60 Railroad Avenue, Hasbrouck Heights, N.J. 07604 (201) 288-6511 FAX: (201) 288-6887

May 06, 1992

Heritage Remediation/Engineering, Inc. Toledo Division 5656 Opportunity Drive Toledo, Ohio 43612

Re: PW Packer Bottom <u>Laboratory Project No.</u> S-2993

Please note the following results for the water sample received on 04/24/92 and analyzed for the following parameters:

Analysis	Results	MDL ppb
	·	
Total Cadmium	ND	20
Total Chromium	ND	20
Total Copper	ND	20
Total Lead	ND	50
Total Arsenic	ND	5
Total Selenium	ND	5
Total Zinc	0.056 mg/l (ppm)	20
Total Mercury	ND	0.05
Iron	1.475 mg/l (ppm)	50
Potassium	1.694 mg/l (ppm)	20
Calcium	79.84 mg/l (ppm)	50
Magnesium	67.56 mg/l (ppm)	50
Carbonate	0.0 mg/l as CaC03	
Bicarbonate	185 mg/l as CaC03	
Sulfate	682 mg/l (ppm)	
Chloride	14.0 mg/l (ppm)	
pН	7.480	
Conductance	1000 micromhos/cm	
Total Alkalinity	185.0 mg/l as CaC03	
Hardness	580.0 mg/l as CaC03	
Total Dissolved Solids	762.0 mg/l (ppm)	

Irving Berkowitz Laboratory Manager

MDL = Method Detection Limit

ND Non Detected (below MDL)

60 Railroad Avenue, Hasbrouck Heights, N.J. 07604

(201) 288-6511 FAX

FAX: (201) 288-6887

May 06, 1992

Heritage Remediation/Engineering, Inc. Toledo Division 5656 Opportunity Drive Toledo, Ohio 43612

Re: PW Packer #4
Laboratory Project No. S-2993

Please note the following results for the water sample received on 04/24/92 and analyzed for the following parameters:

Analysis	Results	MDL ppb
Total Cadmium Total Chromium Total Copper Total Lead	ND ND ND ND	20 20 20 50
Total Read Total Arsenic Total Selenium Total Zinc Total Mercury Iron	ND ND 0.027 mg/l (ppm) ND 1.353 mg/l (ppm)	5 5 20 0.05 50
Potassium Calcium Magnesium Carbonate Bicarbonate	3.220 mg/l (ppm) 84.60 mg/l (ppm) 77.28 mg/l (ppm) 1.0 mg/l as CaCO3 199 mg/l as CaCO3	20 50 50
Sulfate Chloride pH Conductance Total Alkalinity Hardness Total Dissolved Solids	580.0 mg/l (ppm) 14.0 mg/l (ppm) 7.480 1000 micromhos/cm 200.0 mg/l as CaC03 512.0 mg/l as CaC03 781.0 mg/l (ppm)	

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Irving Berkowitz Laboratory Manager

MDL = Method Detection Limit

ND = Non Detected (below MDL)



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FAX: (201) 288-6887

May 06, 1992

Heritage Remediation/Engineering, Inc. Toledo Division 5656 Opportunity Drive Toledo, Ohio 43612

Re: PW Packer #3 Laboratory Project No. S-2993

Please note the following results for the water sample received on 04/24/92 and analyzed for the following parameters:

Analysis	Results	MDL ppb
Total Cadmium	ND	20
Total Chromium	ND	20
Total Copper	ND	20
Total Lead	ND	50
Total Arsenic	ND	5
Total Selenium	ND	5
Total Zinc	0.031 mg/l (ppm)	20
Total Mercury	ND	0.05
Iron	ND	50
Potassium	1.754 mg/l (ppm)	20
Calcium	73.84 mg/l (ppm)	50
Magnesium	65.44 mg/l (ppm)	50
Carbonate	2.0 as CaC03 mg/l	
Bicarbonate	186 sa CaC03 mg/l	
Sulfate	398 mg/l (ppm)	
Chloride	18.0 mg/l (ppm)	
Ħq	7.520	
Conductance	9500 micromhos/cm	
Total Alkalinity	188.0 as CaCO3 mg/l	
Hardness	496.0 as CaCO3 mg/l	
Total Dissolved Solids	720.0 mg/l (ppm)	

Irving Berkowitz Laboratory Manager

MDL = Method Detection Limit ND = Non Detected (below MDL)

60 Railroad Avenue, Hasbrouck Heights, N.J. 07604 (201) 288-6511 FAX: (201) 288-6887

May 06, 1992

Heritage Remediation/Engineering, Inc. Toledo Division 5656 Opportunity Drive Toledo, Ohio 43612

Re: PW Packer #1
Laboratory Project No. S-2993

Please note the following results for the water sample received on 04/24/92 and analyzed for the following parameters:

Analysis	Results	MDL ppb
Total Cadmium	ND	20
Total Chromium	ND ,	20
Total Copper	ND	20
Total Lead	ND	50
Total Arsenic	ND	5
Total Selenium	ND	5
Total Zinc	0.098 mg/l (ppm)	20
Total Mercury	ND	0.05
Iron	ND	50
Potassium	1.826 mg/l (ppm)	20
Calcium	88.04 mg/l (ppm)	50
Magnesium	75.80 mg/l (ppm)	50
Carbonate	2.0 as CaCO3 mg/l	
Bicarbonate	\sim 186 as CaCO3 mg/l $_{\odot}$	
Sulfate	568.0 mg/l (ppm)	
Chloride	21.0 mg/l (ppm)	
pн	7.331	
Conductance	9000 micromhos/cm	
Total Alkalinity	188.0 as CaCO3 mg/l	
Hardness	536.0 as $CaCO3$ mg/l	
Total Dissolved Solids	878.0 mg/l (ppm)	

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Irving Berkowitz Laboratory Manager

MDL = Method Detection Limit
ND = Non Detected (below MDL)

60 Railroad Avenue, Hasbrouck Heights, N.J. 07604 (201) 288-6511 FAX: (201) 288-6887

May 06, 1992

Heritage Remediation/Engineering, Inc. Toledo Division 5656 Opportunity Drive Toledo, Ohio 43612

Re: PW Packer #1 Laboratory Project No. S-2993

Please note the following results for the water sample received on 04/24/92 and analyzed for the following parameters:

Analysis	Results	MDL ppb
Total Cadmium	ND	20
Total Chromium	ND	20
Total Copper	ND	20
Total Lead	ND	50
Total Arsenic	ND	5
Total Selenium	ND	5
Total Zinc	0.098 mg/l (ppm)	20
Total Mercury	ND	0.05
Iron	ND	50
Potassium	1.826 mg/l (ppm)	20
Calcium	88.04 mg/l (ppm)	50
Magnesium	75.80 mg/l (ppm)	50
Carbonate	2.0 as CaC03 mg/l	
Bicarbonate	186 as $CaC03 mg/l$	
Sulfate	568.0 mg/l (ppm)	
Chloride	21.0 mg/l (ppm)	
pН	7.331	
Conductance	9000 micromhos/cm	
Total Alkalinity	188.0 as $CaCO3 mg/l$	
Hardness	536.0 as CaCO3 mg/l	
Total Dissolved Solids	878.0 mg/l (ppm)	

Irving Berkowitz Laboratory Manager

MDL = Method Detection Limit

ND = Non Detected (below MDL)

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ts, N.J. 07604 1-6887

Volatile Organic Analysis Data

61064 Hexel

Matrix: Water

S-2993 PW Packer #1 Dilution Factor: 1 : Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

	UG/L	MDL
ne ide e e uromethane oethene	ND ND ND ND ND	10 10 10 10 5 5
ichloroethene oethane	ND **	5 5 5 5
loroethane achloride bethane	ND ND ND ND 2J	5 5 5 5 5
ene prapane	ND	5
comethane	ND ND	5 5 5
nloropropene oroethane l Vinyl Ether	ND ND	5 5 5
thene omethane e	4J ND ND ND ND	5 5 5 10 10
achloroethane	ND ND	5 5

Volatile Organic Analysis Data Tentatively Identified Compounds

Project No. 61064 Hexel

Sample No. S-2993 PW Packer #1 Dilution Factor: 1 Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

Matrix: Water

1) 2) 3) 4) 5) 6) 7) 8) 9) 10) 11)	ty
2) 3) 4) 5) 6) 7) 8) 9) 10) 11)	
4) 5) 6) 7) 8) 9) 10) 11)	
5) 6) 7) 8) 9) 10) 11)	
6) 7) 8) 9) 10) 11)	
6) 7) 8) 9) 10) 11)	
8) 9) 10) 11)	-
9) 10) 11)	
10)	
10)	
12)	
13)	
14)	
15)	

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Volatile Organic Analysis Data

Project No. 61064 Hexel Matrix: Water Sample No. S-2993 PW Packer #2 Dilution Factor: 1 Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

COMPOUND	UG/L	MDL
Chloromethane	ND	10
Vinyl Chloride	ND	10
Bromomethane	ND	10
Chloroethane	ND	10
Trichlorofluromethane	ND	5
1,1-Dichloroethene	ND	5
Methylene Chloride	ND **	5
Trans-1,2 Dichloroethene	ND	5
1,1 Dichloroethane	ND	5 5 5
Chloroform	ND	5
1,1,1-Trichloroethane	ND	5
Carbon Tetrachloride	ND	5
Benzene	ИD	5
1,2-Dichloroethane	ND	5
Trichloroethene	6.08	5
1,2-Dichloroprapane	ИD	5
Bromodichloromethane	ND	5
Trans-1,3-Dichloropropene	ND	5
Toluene	2Ј	5 5 5
Cis-1,3-Dichloropropene	ND	5
1,1,2-Trichloroethane	ND	
2-Chloroethyl Vinyl Ether	ND	5
Tetrachloroethene	5.96	5
Dibromochloromethane	ND	5
Chlorobenzene	ND	5
Ethylbenzene	ND	5
m&o Xylenes	ND	10
p Xylene	ND	10
Bromoform	ND	5
1,1,2,2-Tetrachloroethane	ND	วิ



NVIRONMENTAL ABORATORIES, INC.

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Volatile Organic Analysis Data

Project No. 61064 Hexel Matrix: Water
Sample No. S-2993 PW Packer #2 Dilution Factor: 1
Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

COMPOUND	UG/L	MDL
1,3-Dichlorobenzene	ND	10
1,2-Dichlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
Methyl Tert. Butal Ether (MTBE)	2J	50
Tertiary Butal Alcohol (TBA)	ND	10

None Detected ND =

MDL = Method Detection Limit

J = Below Method Detection Limit

= Compound Found In Laboratory Blank

SURROGATE COMPOUNDS	RECOVERY	LIMITS
1,2-Dichloroethane-d4	96%	70-121
Toluene-d8	96%	81 - 117
4-Bromofluorobenzene	107%	74-121

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FAX: (201) 288-6887

Volatile Organic Analysis Data Tentatively Identified Compounds

Project No. 61064 Hexel Matrix: Water Sample No. S-2993 PW Packer #2 Dilution Factor: 1 Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

COMPOUND NAME	RT	EST. CONC. ug/l	Quality
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			
11)			
12)			
13)			
14)			
15)			
		<u> </u>	·

Volatile Organic Analysis Data

Project No. 61064 Hexel

Project No. 61064 Hexel Matrix: Water
Sample No. S-2993 PW Packer #3 Dilution Factor: 1
Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

COMPOUND	UG/L	MDL
Chloromethane Vinyl Chloride Bromomethane Chloroethane Trichlorofluromethane 1,1-Dichloroethene	ND ND ND ND ND	10 10 10 10 5 5
Methylene Chloride Trans-1,2 Dichloroethene 1,1 Dichloroethane Chloroform	ND ** ND ND ND	5 5 5 5
1,1,1-Trichloroethane Carbon Tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloroprapane	ND ND ND ND 6.58 ND	5 5 5 5 5 5 5
Bromodichloromethane Trans-1,3-Dichloropropene Toluene Cis-1,3-Dichloropropene 1,1,2-Trichloroethane 2-Chloroethyl Vinyl Ether	ND ND 21.28 ND ND ND	5 5 5 5 5 5
Tetrachloroethene Dibromochloromethane Chlorobenzene Ethylbenzene m&o Xylenes p Xylene	4J ND ND ND ND ND	5 5 5 5 10
Bromoform 1,1,2,2-Tetrachloroethane	ND ND	5 5

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Volatile Organic Analysis Data

Project No. 61064 Hexel Matrix: Water Sample No. S-2993 PW Packer #3 Dilution Factor: 1 Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

COMPOUND	UG/L	MDL
1,3-Dichlorobenzene	ND	10
1,2-Dichlorobenzene 1,4-Dichlorobenzene	ND ND	10 10
Methyl Tert. Butal Ether (MTBE) Tertiary Butal Alcohol (TBA)	1J ND	50 10

None Detected

= Method Detection Limit

J = Below Method Detection Limit

= Compound Found In Laboratory Blank

RECOVERY	LIMITS
98%	70-121
98%	81-117
107%	74-121
	98% 98%

Volatile Organic Analysis Data Tentatively Identified Compounds

Project No. 61064 Hexel

Matrix: Water

Sample No. S-2993 PW Packer #3 Dilution Factor: 1 Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

COMPOUND NAME	EST. CONC. RT ug/l Quality
1)	
2)	
3)	
4)	
5)	
6)	
7)	
8)	
9)	
10)	
11)	
12)	
13)	·
14)	
15)	

Volatile Organic Analysis Data

Project No. 61064 Hexel Matrix: Water Sample No. S-2993 PW Packer #4 Dilution Factor: 1 Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

COMPOUND	UG/L	MDL
Chloromethane Vinyl Chloride Bromomethane Chloroethane Trichlorofluromethane 1,1-Dichloroethene	ND ND ND ND ND ND	10 10 10 10 5
Methylene Chloride Trans-1,2 Dichloroethene 1,1 Dichloroethane Chloroform	ND ** ND ND ND	5 5 5 5
1,1,1-Trichloroethane Carbon Tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloroprapane	ND ND ND ND 7.4 ND	5 5 5 5 5 5 5
Bromodichloromethane Trans-1,3-Dichloropropene Toluene Cis-1,3-Dichloropropene 1,1,2-Trichloroethane 2-Chloroethyl Vinyl Ether	ND ND ND ND ND ND	5 5 5 5 5 5 5
Tetrachloroethene Dibromochloromethane Chlorobenzene Ethylbenzene m&o Xylenes p Xylene	3J ND ND ND ND ND	5 5 5 10 10
Bromoform 1,1,2,2-Tetrachloroethane	ND ND	5 5



ALL-TEST ENVIRONMENTAL LABORATORIES, INC._

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FAX: (201) 288-6887

Volatile Organic Analysis Data

Project No. 61064 Hexel Matrix: Water Sample No. S-2993 PW Packer #4 Dilution Factor: 1 Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

COMPOUND	UG/L_	MDL
1,3-Dichlorobenzene	ND	10
1,2-Dichlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
Methyl Tert. Butal Ether (MTBE)	2J	50
Tertiary Butal Alcohol (TBA)	ND	10

None Detected ND =

MDL = Method Detection Limit

J = Below Method Detection Limit

= Compound Found In Laboratory Blank

SURROGATE COMPOUNDS	RECOVERY	LIMITS
1,2-Dichloroethane-d4	96%	70-121
Toluene-d8	99%	81-117
4-Bromofluorobenzene	107%	74-121

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Volatile Organic Analysis Data Tentatively Identified Compounds

Project No. 61064 Hexel Matrix: Water Sample No. S-2993 PW Packer #4 Dilution Factor: 1

Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

RT	est. conc.	Quality
3.33	22.88	0
39.72	29.86	0
40.85	53.35	37
	3.33	3.33 22.88 39.72 29.86

60 Railroad Avenue, Hasbrouck Heights, N.J. 07604 (201) 288-6511

FAX: (201) 288-6887

Volatile Organic Analysis Data

Project No. 61064 Hexel Matrix: Water
Sample No. S-2993 PW Bottom Dilution Factor: 1
Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

COMPOUND	UG/L	MDL
Chloromethane Vinyl Chloride Bromomethane Chloroethane Trichlorofluromethane 1,1-Dichloroethene	ND ND ND ND ND	10 10 10 10 5
Methylene Chloride Trans-1,2 Dichloroethene 1,1 Dichloroethane Chloroform	ND ** ND ND ND	5 5 5 5
1,1,1-Trichloroethane Carbon Tetrachloride Benzene 1,2-Dichloroethane Trichloroethene 1,2-Dichloroprapane	ND ND ND ND 4J ND	5 5 5 5 5 5 5
Bromodichloromethane Trans-1,3-Dichloropropene Toluene Cis-1,3-Dichloropropene 1,1,2-Trichloroethane 2-Chloroethyl Vinyl Ether	ND ND 31.4 ND ND ND	5 5 5 5 5 5 5
Tetrachloroethene Dibromochloromethane Chlorobenzene Ethylbenzene m&o Xylenes p Xylene	IJ ND ND ND ND	5 5 5 10 10
Bromoform 1,1,2,2-Tetrachloroethane	ND ND	5 5

Volatile Organic Analysis Data

Project No. 61064 Hexel Matrix: Water Sample No. S-2993 PW Bottom Dilution Factor: 1

Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

COMPOUND	UG/L	MDL
1,3-Dichlorobenzene	ND	10
1,2-Dichlorobenzene	ND	10
1,4-Dichlorobenzene	ND	10
Methyl Tert. Butal Ether (MTBE)	lJ	50
Tertiary Butal Alcohol (TBA)	ND	10

ND = None Detected

MDL = Method Detection Limit

J = Below Method Detection Limit

= Compound Found In Laboratory Blank

SURROGATE COMPOUNDS	RECOVERY	LIMITS
1,2-Dichloroethane-d4	94%	70-121
Toluene-d8	100%	81-117
4-Bromofluorobenzene	108%	74-121

By:

Volatile Organic Analysis Data Tentatively Identified Compounds

Project No. 61064 Hexel

Matrix: Water

Sample No. S-2993 PW Bottom Dilution Factor: 1

Client Name: Heritage Rem/Eng. Co. Date Analyzed: 04/25/92

COMPOUND NAME	RT	EST. CONC. ug/l	Quality
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)	·		
11)			
12)			
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15)			

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